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MCCALL OIL AND CHEMICAL CORPORATION
FOCUSED REMEDIAL INVESTIGATION WORKPLAN
PORTLAND, OREGON

FINAL

Submitted to:

McCall Oil and Chemical Corporation
808 SW 15th Avenue
Portland, Oregon 97205

Prepared by:

IT Corporation
A Member of The IT Group

Project No. 812807

Revision 1

November 16, 2000

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1.0 INTRODUCTION

On behalf of McCall Oil & Chemical Corporation (MOCC) and Great Western Chemical Company (GWCC), IT Corporation (IT) developed this final workplan for a focused remedial investigation (RI) at the MOCC/GWCC facility in Portland, Oregon. This version of the workplan addresses the Oregon Department of Environmental Quality (DEQ) comments (DEQ, 2000d) on the draft workplan (IT, 2000b). The workplan was prepared pursuant to a "Voluntary Agreement For Remedial Investigation and Source Control Measures" (the Agreement) entered into between MOCC/GWCC and the DEQ on May 8 as amended on August 13, 2000. The Agreement requires MOCC/GWCC to conduct an RI that satisfies the requirements of OAR 340-122-080 and to assess and implement, as needed, source control measures to address contaminant migration from the facility to the Willamette River consistent with OAR 340-122-070. This document satisfies the RI workplan described in the scope of work (SOW), Attachment B, to the Agreement.

The Agreement is a response to the DEQ's efforts to investigate at a facility-by-facility level, potential upland sources of contamination along the Portland Harbor. Information from this investigation may be used to support the Portland Harbor sediment RI and feasibility study (FS) as applicable. The overlying goal of the Agreement, therefore, focuses on whether past or present activities at the facility currently contribute, or have the potential to contribute, to impacts on Willamette River water and sediments. The RI scope of work defined in this workplan develops a strategy that will achieve this goal.

The Agreement calls for a number of documents, including an RI proposal and workplans or reports, that address elements of the SOW. Since entering into the Agreement, MOCC/GWCC submitted an RI proposal (IT, 2000a) and received comments on that document from the DEQ in a letter dated July 12, 2000 (DEQ, 2000c). MOCC/GWCC and IT met with the DEQ to discuss those comments and to clarify issues of concern to the DEQ. The next step in the process is submittal of this focused RI workplan, which describes the elements for characterizing the site and evaluating the data with respect to potential risk posed to human health or the environment. As needed, future submittals may address risk assessment (RA) or source control measures (SCMs).

This workplan develops the approach and rationale to meet the requirements stated above. Specific media to be sampled and the locations and types of field or laboratory analyses are described. If, on the basis of the findings of this stage of work and in consultation with the DEQ, additional fieldwork is deemed necessary to address data gaps, that scope of work will be developed in subsequent workplans or workplan amendments.

Standard field operating procedures for drilling groundwater probes, collecting and analyzing samples, cleaning equipment, and managing investigation-derived waste are described in the sampling and analysis plan (SAP) (Appendix A). A quality assurance project plan (QAPP) is included as Appendix B, and a site-specific health and safety plan is included as Appendix C.

2.0 SITE BACKGROUND

The information described in this section (Subsections 2.1 through 2.3) is summarized from background and facility operations information presented in the April 5, 1994, Preliminary Assessment of McCall Oil & Chemical Corporation (MOCC) and Great Western Chemical Company (GWCC), ESCI ID # 134 (EMCON, 1994b), the RI Proposal (IT, 2000a), and periodic reports of water quality data. A copy of the RI proposal is included in Appendix D to supplement the summary presented below. A response to DEQ's July 12 comments on the RI proposal is presented in Section 2.5.

2.1 Synopsis of Site Background

The site is located in the industrialized area of northwest Portland along NW Front Avenue (see Figure 2-1). It occupies approximately 36 acres on the southwest bank of the Willamette River. The site encompasses six tax lots. GWC Properties, Inc., a subsidiary of MOCC, owns tax lot 17. MOCC owns tax lot 96. The Port of Portland (Port) owns lots 15, 24, 26, and 27. GWCC occupies tax lot 17; MOCC occupies tax lots 15, 24, 26, and 96 (see Figure 2-2). Before 1966, most of the land now included in lots 15, 24, and 26 was submerged beneath the Willamette River. The Port created new land along the Willamette during the mid-1960s by dredging and filling along the shore. This land, including a portion of the subject site, was deeded to the Port by the state of Oregon in 1967.

The property is currently occupied by two separate facilities: MOCC, which operates a marine terminal and asphalt facility, and GWCC, which operates a chemical distribution facility (see Figure 2-3). Until 1995, the GWCC facilities consisted of two operating units, the GWCC Technical Center and the GWCC Portland Branch. The Technical Center included the former Chemax operations. In 1995, GWCC's two operating units were merged into the Portland Branch. Current and historical activities associated with the operations of each of these facilities are discussed in detail in chapters two through five of the RI Proposal (Appendix D).

The site is included in the Willamette Greenway (Greenway) established by the City of Portland to monitor and control land use next to the river. The site and surrounding properties are zoned for heavy industrial use, both within the Greenway on the left bank (facing downriver) and outside of the Greenway. Surrounding industries include: petroleum bulk distribution terminals, chemical plants, sand and gravel operations, a steel fabrication facility, shipyards, and rail yards.

In the mid-1920s, the Port purchased the property now occupied by MOCC and GWCC as part of an approximately 65-acre parcel that stretched from the lands owned by Union Oil Company of California (Unocal) on the west, to the Willamette River. Prior to the mid-1940s the property was vacant. In 1946, Pioneer Flintkote Company (Flintkote) purchased two parcels from the Port, corresponding generally to present site tax lots 17 and 96. These tax lots are currently occupied by GWCC and the MOCC asphalt plant, respectively.

Flintkote manufactured asphalt roofing shingles and tiles on the property from 1947 to approximately 1982. A factory, a warehouse for roofing material, silos, boilers, aboveground and underground storage tanks (ASTs and USTs, respectively), and retorts were situated on tax lot 17. Historical occupation records indicate that Standard Oil Company operated a distribution center at the address corresponding to adjacent tax lot 96 during the 1950s (SAFE, 1994). By 1960, Douglas Oil Company (Douglas) occupied this address, and operated an asphalt facility. In 1962, Douglas purchased tax lot 96 from Flintkote. Douglas and Flintkote continued to operate their respective facilities until 1982, when both parcels and the improvements were sold to MOCC. Erro Enterprises (Erro), a McCall family subsidiary, purchased the asphalt facility from MOCC in 1982 and operated the facility until 1992, when it was sold back to MOCC. GWC Properties, Inc., now owns tax lot 17.

Chemax began operations on the former Flintkote site in early 1984. The Portland branch began its on-site operations in late 1985. In 1985, MOCC operated a lube oil distribution facility on part of the asphalt plant site. The lube oil operations were discontinued in 1991.

In the early to mid-1960s, the Port used dredge spoils from the Willamette River channel (primarily fine sand) to create new land along the Willamette River next to the Flintkote and Douglas facilities. As stated previously, this land was subsequently deeded to the Port by the state of Oregon in 1967. In the mid-1970s, MOCC constructed the marine terminal on the filled land (corresponding approximately to tax lots 15, 24, 26 and 27).

2.2 Site Conditions

The following discussion of site conditions is taken from Sections 6 and 8 of the RI proposal and earlier characterization reports (EMCON, 1994a,b,c). Specific site information such as boring logs and water quality trend plots for monitoring wells can be found in Appendices E and F, respectively. Cross-sections of site hydrogeology are shown in Figure 11 of the RI proposal (Appendix D).

2.2.1 Stormwater

Under their respective National Pollutant Discharge Elimination System (NPDES) permits, MOCC and GWCC test stormwater for the constituents listed below. With a few minor exceptions, MOCC and GWCC have met their stormwater permit monitoring criteria.

PARAMETER	LIMITATION
Oil & grease	Shall not exceed 10 mg/L
pH	Shall be between 6.0 and 9.0
Oil & grease	No visible sheen
	BENCHMARK
Total copper	O.1 mg/L
Total lead	0.4 mg/L
Total zinc	0.6 mg/L
Total suspended solids	130 mg/L
Floating solids (associated with industrial activities)	No visible discharge

With respect to stormwater analysis for metals, MOCC/GWC has historically tested for arsenic, cadmium, chromium, copper, lead, mercury, nickel, and zinc.

2.2.2 Hydrogeology

The site, and the surrounding industrial area, is situated on fill dredged from the Willamette River. The dredged sediments were used to fill lakes in the area from the early 1900s to the 1940s. The upper 20 to 35 feet of sediments beneath the site and the surrounding vicinity consist of fine-to medium-grained silty, sandy dredge-spoils and pre-fill sediments. The fill layer is generally homogeneous, with some silt and clay lenses. The fill overlies the original surface of lake bottom sediments, marsh silts, and alluvial silts and silty clays. The depth of the pre-fill alluvium ranges from just below the ground surface (bgs) down to a depth of approximately 20 feet bgs, and is characterized by interbedded gray silt and clay with lesser amounts of sand (EMCON, 1994a).

A 1948 aerial photograph of the site shows that the Willamette River shoreline (and therefore the hinge-line for fill and pre-fill sediments) was situated just northeast of the current GWCC facility (Figure 5 in EMCON, 1994b). Areas northeast of GWCC buildings, including the MOCC marine terminal, are founded on more recently dredged silty, sandy fill material, that overlie alluvial silts and clays. Cross sections of the site provide a general illustration of the site geology (Figure 11 in Appendix D). Lithology of site soils is shown on the boring logs for monitoring wells (Appendix E).

The uppermost aquifer is unconfined at the site. Groundwater migrates southwest to northeast across the site from the Willbridge Terminal to the Willamette River. The Willamette River is the regional discharge boundary for shallow and deep groundwater. The groundwater elevation contours for February 1999 are shown on Figure 2-4. These have been consistent, with minor seasonal fluctuations, throughout the past five years of monitoring at the site.

Groundwater in the uppermost aquifer occurs in the dredge spoil sands and in the underlying pre-fill sediments. The pre-fill alluvial sediments are generally siltier than the dredge spoils. This fine-grained nature of the pre-fill alluvium tends to perch groundwater in the overlying dredge fill. Recharge to groundwater is primarily from underflow upgradient of the site, since on-site infiltration of incident precipitation is mostly prevented by buildings and pavement over much of the site.

Depth to groundwater ranges from approximately 13 to 19 feet across the site. During the period 1994 to 1999, groundwater elevation changes have ranged from less than 2 feet in upgradient wells (e.g., EX-7) to slightly greater than 5 feet in downgradient wells (e.g., EX-2). On average, it appears that groundwater elevations have risen by approximately 2 feet in the past six years. Figure 2-5 and Table 2-1 show hydrographs and the water level database, respectively, for the site.

2.2.3 Site Groundwater Quality

MOCC and GWCC have been monitoring groundwater since 1994. There are eleven monitoring wells in the network (Figure 2-4). The monitoring wells are all less than 30 feet deep and are designed to monitor the uppermost aquifer at the site. Well construction details are listed in Table 2-2.

Groundwater has been tested routinely for total petroleum hydrocarbons (TPH) (EPA methods 3510/8015 modified) and for volatile organic compounds (VOCs) using EPA method 8260A. Water quality data from 1994 through 1999 is summarized on Table 2-3. Concentration trends for detected VOCs and total petroleum hydrocarbons are shown graphically for representative wells in Appendix F.

The water quality data show that shallow groundwater at the site has fairly widespread low level concentrations of diesel and other undifferentiated hydrocarbons in the heavier oil range. Monitoring well EX-1 is downgradient of the solvent tank farm and drumming shed and has moderate concentrations of chlorinated solvents. Well EX-6 is downgradient of EX-1 and has trace concentrations of chlorinated VOCs. Wells MW-1 and MW-4 also have had some detections of chlorinated VOCs. The wells adjacent to the Willamette have had no detections of VOCs.

The monitoring data to date indicate that shallow groundwater with low concentrations of diesel and heavy oil appears to be discharging from the site to the Willamette River. The concentrations of petroleum hydrocarbons in the site wells have been fairly consistent, with possible minor seasonal variations. No free petroleum product has been detected in groundwater at the site. The petroleum hydrocarbon contribution from the upgradient Willbridge terminal has not been determined.

2.2.4 Soil Quality

Soil samples were obtained during installation of six site monitoring wells (EX-1 to EX-6). The soil samples were field screened using a flame ionization detector and two soil samples from each borehole were tested for TPH using EPA methods 3540/8015 modified.

Soil from the upper five feet of boreholes EX-1, -2, -5, and -7 contained oil that was quantified using 30 weight motor oil as the lab standard. The oil concentrations ranged from 28 to 321 milligrams per kilogram (mg/kg). No fuel hydrocarbons were detected in any of the soil samples. The samples from boring EX-3 had no hydrocarbon detections. The shallow soil sample from boring EX-6 had an oil concentration of 4,400 mg/kg.

There were no hydrocarbons detected in soil samples collected from depths greater than five feet. This indicates that there is little oil present in the groundwater table fluctuation zone.

2.3 Source Area Prioritization

Based on IT's review of locations of chemical handling and storage structures, documented historical spills (both of which are discussed in the RI proposal), and DEQ comments of July 12, the following source areas have been prioritized for evaluation as part of the focused RI (see Sections 3 and 4 for a discussion of the evaluation approach and methods).

- McCall Oil & Chemical Corporation
  - Diesel truck loading rack
  - Asphalt truck loading rack
  - Asphalt plant AST tank farm
  - Railcar loading/unloading facility
  - Marine terminal AST tank farm

- Great Western Chemical Company
  - Railcar loading/unloading facility
  - Acid/solvent AST tank farm
  - Drumming shed
  - Former CCA production area (North Plant)

These general areas represent a number of individual possible sources or historical spill locations with the highest potential to release chemicals to the environment. The sampling plan discussed in Section 4 is designed to test groundwater and stormwater downgradient of these areas. Chemicals of potential concern associated with these areas will be included in the testing program discussed in the next Section.

2.4 COPCs

Preliminary site chemicals of potential concern (COPCs) have been selected on the basis of chemicals that were (1) historically or currently used or stored at the facility, (2) detected in adjacent Willamette River sediment samples, or (3) detected in site stormwater. Classes of chemicals to be tested with respect to site operations include the following:

- Chlorinated VOCs
- Total petroleum hydrocarbons as diesel and oil (TPH)
- Polynuclear aromatic hydrocarbons (PAHs)
- Metals (arsenic, cadmium, chromium, copper, lead, and zinc)

Total petroleum hydrocarbons will be tested at the site for the purpose of identifying and characterizing potential upland source areas. TPH will not be considered a COPC for assessing risk because there is no method to assess risk using TPH directly. Components of TPH, which include PAHs, will be tested in groundwater and stormwater and assessed for potential environmental risk.

Chlorinated VOCs have not been identified as Willamette River target compounds by DEQ, but chlorinated VOCs have been detected in groundwater at the site. Therefore, these compounds have been identified as preliminary COPCs for the site.

The Portland Harbor Sediment Investigation Report (Weston, 1998) cited six Willamette River sediment sampling locations near the site. Sample locations SD 114, 115, 117, 118, 120 and 123 are shown on Figure 2-4. The Weston investigation obtained surface sediment samples (0 to 10 cm depth) at all locations. Subsurface core samples also were obtained at locations SD 117 and SD 120 (0 to 90 cm depth).

The Weston samples were tested for inorganic, semivolatile organic compounds (SVOCs), VOCs, pesticide and organotin compounds. On pages 2 and 3 of the Oregon DEQ's Voluntary Agreement with MOCC/GWCC, the agency listed the following compounds that exceeded baseline concentrations established for the Portland Harbor Study Area:

Surface Sediment Constituents Exceeding Baseline Values:

aluminum	zinc
cadmium	4-methylphenol
cobalt	butylbenzylphthalate
lead	di-n-octylphthalate
mercury	

Subsurface Sediment Constituents Exceeding Baseline Values:

aluminum	4-methylphenol
barium	dibenzofuran
cobalt	LPAH
mercury	HPAH
zinc	

With one exception, all of the constituent concentrations were well below dredge screening criteria. The exception was the shallow sample from SD 120 that had a 4-methylphenol concentration of 880 mg/kg. The dredge screening criteria for this compound is 670 mg/kg. Of these chemicals, the four SVOCs and PAHs were retained for testing at the site. None of the listed metals are part of any process nor are they stored at the MOCC/GWCC facility. While cadmium, lead, and zinc are included as preliminary COPCs, they were not selected on the basis of the Portland Harbor sediment evaluation, but rather because of their occurrence in stormwater.

Six metals identified as preliminary COPCs were selected because they were previously used in chemical production (copper, chromium, and arsenic) or had been detected in site stormwater (cadmium, lead, and zinc).

In summary, the following preliminary COPCs will be tested during this focused RI:

- Chlorinated VOCs

- TPH as diesel and oil
- PAHs
- Metals (arsenic, cadmium, chromium, copper, lead, and zinc)
- SVOCs - 4-methylphenol, butylbenzylphthalate, di-n-octylphthalate, dibenzofuran

2.5 Response to DEQ's Specific Comments on RI Proposal

In the following section, we respond to specific comments of the DEQ's July 12, letter regarding the RI Proposal. DEQ comments are italicized with a response following. General comments not covered below (e.g., about work scope or rationale) are addressed in Sections 3 or 4 of the workplan. Although the July 12 comments suggest that the RI Proposal be modified to reflect DEQ comments, it is MOCC/GWCC's understanding that DEQ is not expecting a revised version of the document.

Section 4.2.2 – GWCC South Plant Operations: Releases associated with product transfer in the railcar unloading areas may have occurred. This represents a potential source area that may required characterization.

Groundwater is proposed to be tested downgradient of this area.

The 28 bulk chemical ASTs represent a potential source area. Groundwater data indicates that elevated levels of chlorinated solvents are present in groundwater downgradient from this area.

Groundwater is proposed to be tested downgradient of this area.

Truck load racks also represent a potential release point that may require characterization.

Groundwater is proposed to be tested downgradient of this area.

The RI work plan should clarify the truck cleaning operations. If the inside of tank cars were cleaned out, this represents a potential source area.

Only the exteriors of trucks were cleaned.

Section 4.3.3 – GWCC North Plant Operations: Groundwater sampling for metals should be performed downgradient of this source area.

Sampling in this area is proposed in this workplan.

Section 5.1.1: Information should be provided regarding potential releases from the 6,000 gallon heating oil tank and the chlorinated solvent shed.

All available information on historic releases has been provided in the RI proposal. The solvent shed has a roof, a concrete floor, and a concrete curb for secondary containment. We don't have any other information on the UST beyond what is in the RI proposal. The UST decommissioning report for the 1,000 gallon tank cited in this section can be found in Appendix G. When originally prepared in 1989, the report was forwarded to the DEQ's Environmental Cleanup Division, LUST Section.

The arsenic and chromic acid storage areas represent a potential source area that should be characterized. Groundwater downgradient from this area should be sampled for metals (presumably EX-1).

Arsenic and chromic acids were stored only at the former Chemax facility. Dissolved arsenic and chromium had been tested in past site investigations and follow-up sampling is therefore proposed in this workplan at locations downgradient of the Chemax facility (i.e., in wells MW-1 and MW-4). These acids were not stored in the AST tank farm upgradient of EX-1.

Section 6.1: The conceptual model does not include potential food chain exposure routes (i.e., fish consumption). Although this is an exposure pathway that will be evaluated through the Portland Harbor RI/FS, it should be included in Figure 10.

The conceptual site model (CSM) will be modified to show this pathway. A revised drawing is included in Appendix D. See comment in Section 3.2 on potential for exposure through this route.

Section 6.2: The work plan should note that although the presence of pavement may prevent current exposures to surface soil, future exposures to surface soil may occur if the pavement is removed.

So noted.

Section 6.4: The groundwater section should note that groundwater in the vicinity of the site has historically been used for industrial purposes. In fact, an industrial water supply well is located at the Chevron asphalt plant across Front Avenue from the site.

So noted. Section 4.4.2 of this workplan discusses tasks proposed for evaluating beneficial uses of water in the area.

Section 8.1: Site chemicals of potential concern (COPCs) should be based on site operations as well as sediment data. Chemicals such as volatile organic compounds (VOCs) and total petroleum hydrocarbons (TPH) were not analyzed in the Weston study and may be impacting Willamette River surface water and/or sediments.

This workplan includes the proposed testing of groundwater and stormwater for chlorinated VOCs. See Section 2.4 of this workplan for a discussion of testing for TPH.

Section 8.3: VOCs have been detected in monitoring wells MW-1 and MW-4 and may be migrating towards the Willamette River; however, there are no downgradient monitoring wells to make this evaluation.

Groundwater monitoring in this area is proposed in this workplan.

Section 8.4: The lack of any soil boring data beyond TPH is a significant data gap.

As discussed in Section 3, this RI workplan focuses on the evaluation of potential contaminant pathways to the Willamette River. If the proposed groundwater and stormwater pathway evaluations identify source areas that need further study, soil testing may be appropriate.

Section 10.2: The initial phase of the investigation appears too limited. Potential sources should be prioritized and evaluated to determine whether there are data gaps associated with them. In addition, sediment data should be included at likely discharge points from the site to the Willamette River. Sediment sample locations should include the stormwater outfalls depicted on figure six and downgradient from TPH detections in groundwater. Analytes should be selected based on potential site sources.

Section 2.3 of this workplan identifies potential source areas to be investigated. Section 4 of this workplan describes the use of Geoprobes to obtain groundwater data downgradient of potential source areas. Tables 4-1 and 4-2 list the potential source areas being investigated and the chemicals targeted for testing.

Sediment testing at MOCC/GWCC stormwater discharge points would likely produce inconclusive and potentially misleading data unless taken in the context of a river wide sampling effort. Our understanding is that the river-wide sediment RI is pending further agency evaluation.

Tables 4, 8A and 8B: The tables apparently focus only on current contents. Historic contents should also be included (for example, which tanks held arsenic and chromic acids).

These tables reflect the tank contents as of May 2000. An inventory of tank contents in 1994 was provided in Tables 5 and 10 of the April 1994 Preliminary Assessment (EMCON, 1994).

Table 13: This table appears to be a duplicate of Table 12.

This table was number 13 in an early draft of the RI Proposal, and was mistakenly duplicated during report production.

3.0 OBJECTIVES AND APPROACH

This section links the overall goals and objectives of the focused RI with objectives previously identified in the Agreement. It then discusses the conceptual site model in the context of the RI objectives and the groundwater and stormwater pathways investigation.

3.1 Goal of Focused RI

As stated in Section 1, the overlying purpose for the DEQ entering into agreements with property owners along the Willamette River was to address possible upland conditions that may contribute to sediment contamination in the Portland Harbor project area of concern. The investigation at the MOCC/GWCC facility, therefore, focuses on the transport mechanisms and exposure pathways that could contribute to river sediment impacts (i.e., through groundwater and stormwater). The investigation approach evaluates groundwater quality in the upper aquifer as a whole and assesses whether any contaminants detected will pose a risk to the river. Stormwater quality also will be evaluated at the site discharge points. If impacts to stormwater or groundwater are detected that pose a risk to river sediments, the source of those impacts will be investigated further so that adequate controls at the source can be designed and implemented.

The primary goal of the focused RI is to identify and characterize potential contaminant sources, if any, at the MOCC/GWCC facility that could contribute to river sediment impacts. This goal translates to a number of project specific objectives developed for this workplan. These include the following:

- Characterize groundwater quality in upper aquifer and screen for COPCs.
- Characterize stormwater quality.
- Characterize hydrogeology of site to assess dynamics of groundwater flow and contaminant transport.
- Conduct fate and transport analyses to determine if stormwater and/or groundwater pathways have potential current or future unacceptable impact on the river.
- Conduct source area evaluation(s) if fate and transport analyses indicate potential current or future unacceptable river impact.

3.2 RI Objectives Defined in Agreement

The Agreement listed a number of generic objectives in Section II of the SOW. These are paraphrased below and then discussed in the context of work already completed or proposed as part of this focused RI workplan.

A. Identify and characterize upland hazardous substance source areas.

B. Evaluate contaminant migration pathways from upland to river.

C. Determine nature and extent of upland affected media.

D. Identify human and ecological receptors.

E. Collect upland data to allow identification of possible areas of sediment contamination.

F. Conduct risk assessment.

G. Determine if upland hot spots are present.

H. Achieve adequate data quality for site characterization and risk assessment.

I. Develop information necessary to evaluate and implement necessary source control measures, if needed.

J. Implement necessary source control measures.

RI objectives A and B have been largely completed through the efforts of the 1994 Preliminary Assessment (EMCON, 1994b), preparation of the RI proposal (IT, 2000a), and the monitoring that has occurred since 1994. The RI proposal documented the areas of MOCC and GWCC industrial activity and locations of documented releases. This information was an important criterion used in the design of the existing groundwater and stormwater monitoring programs. Existing stormwater and groundwater monitoring points are downgradient of historic release areas and the most active areas of industrial operations. Additional characterization proposed as part of this focused RI will complement current information on potential source areas and the lateral extent of groundwater impacts associated with those sources.

The RI proposal evaluated potential exposure pathways through the CSM. The investigative work already completed at the MOCC and GWCC facilities has identified potential source areas and migration pathways to the degree necessary to identify data gaps.

RI objective C has not been completed primarily because the preliminary COPCs have not been analytical targets in past investigations or monitoring programs at the site. The focused RI workplan is designed to address this objective with respect to groundwater and surface water impacts to the river.

RI objective D has been largely completed through the CSM analysis described in the RI proposal and as discussed below. The DEQ noted in its July 12 comment letter that the CSM did not include potential food chain exposure routes (i.e., fish consumption). This exposure route has been included on a revised copy of the figure in Appendix D, even though it will be evaluated through the Portland Harbor RI/FS and not in this site RI. With respect to goals identified for this focused RI, potential receptors include recreational and ecological river receptors through the groundwater and surface water pathways. Other receptors identified for exposure in the CSM (e.g., industrial on-site workers and trench workers) are not fully evaluated in this focused RI because they are outside the purpose of the Agreement. However, further source area characterization may provide data for a limited assessment of human health exposure pathways for industrial on-site workers or trench workers in the source areas. The CSM did not identify individual ecological receptors that may exist on the upland part of the site, or in the river. Identification of these potential receptors is discussed in Section 4.5

Contaminant transport pathways also will be evaluated as part of a Level 1 ecological scoping assessment (Section 4.5) to allow identification of possible areas of sediment contamination as required in objective E. The effort will focus on pathways from the upland to the river. The focused RI will not include an investigation of the river or river sediment as this would potentially be duplicative of activities proposed for the Portland Harbor RI/FS. Any sediment data collected would lack the necessary context of sediment dynamics and upriver-downriver sediment chemistry data critical to understanding the origin of possible sediment contamination.

Objective F will be met with completion of a risk assessment focused on the surface water and groundwater pathways as they potentially affect ecological receptors at the river. As discussed above, human exposure through fish consumption may be evaluated later as part of the Portland Harbor RI/FS. However, it appears that the preliminary COPCs at the site have little potential to accumulate in fish tissue. For example, PAHs are generally metabolized by fish and do not accumulate to any significant level in fish tissue. It is unlikely that a human health risk assessment will be applicable for the site.

Groundwater and stormwater quality data (and potentially soil data from characterizing source areas) collected for RI objectives C and E, also will be used to meet objective G. The data will be evaluated for indications of the possible presence of an upland hot spot and whether that hot spot poses a risk to river sediments.

Data quality objectives required to meet objective H are specified in the quality assurance and quality control plan in Appendix B.

This focused RI workplan has been designed to gather the necessary data to evaluate source control measures to meet objective I, should the risk assessment indicate such measures are needed. If the risk assessment indicates that source control measures are needed, the feasibility study would identify additional data needs required for the design of source control measures. Any designed source controls would be implemented to meet objective J.

3.3 Preliminary Conceptual Site Model

The CSM identifies the sources, pathways and receptors that were considered in designing the focused RI workplan. Although MOCC and GWCC operate independently, the CSM covers both facilities because the two facilities are adjacent to each other, and have potentially overlapping exposure pathways to the Willamette River.

The preliminary CSM prepared for the site was developed in Section 6 of the RI Proposal (Appendix D). Figure 10 from that document illustrates the site's potential exposure pathways from potential source areas to potential receptors. The CSM considers all media, including soil, groundwater, surface water, sediment, and air.

Four classes of potential receptors were identified in Figure 10 on the basis of current and reasonably likely future land use. The site and surrounding area are currently used for industrial purposes, are zoned industrial, and are likely to remain industrial for the foreseeable future.

Of concern to this focused RI are the recreational users of the Willamette River and ecological receptors. For the purposes of the CSM, all flora and fauna potentially exposed to river water or sediments are grouped under the heading of ecological receptors. Potential secondary contaminant sources to these receptors are groundwater and stormwater (i.e., surface water) that discharge to the Willamette River water and sediments. Therefore, these are the two sources (i.e., functioning pathways) that are addressed in the focused RI workplan.

The CSM also identified some exposure routes for trench workers and industrial on-site workers. As appropriate, these exposure routes may be assessed in areas that are more fully characterized because they were identified as sources potentially contributing to Willamette River sediment impacts

3.4 Technical Approach to Meeting Project Specific Objectives

The technical approach considers that the two primary pathways for moving contaminants from the site to the river sediment are groundwater and surface water. The scope of work addresses these by testing groundwater in the upper aquifer, and surface water and sediment in the stormwater catchbasins for a list of preliminary COPCs.

3.4.1 Groundwater

The design of the groundwater sampling plan considers that groundwater flows from the site to the river (i.e., the average gradient is toward the river). Sampling points will be distributed uniformly across the site to test the aquifer water quality along the three profiles described below, which are oriented approximately parallel to groundwater contours (see Figure 2-4).

- Upgradient – tests water quality entering from offsite and provides information on whether contaminants are possibly originating from other sources.
- Mid-facility – tests water quality immediately downgradient of potential source areas at the GWCC operations and the MOCC asphalt plant.
- Downgradient – tests water at the downgradient edge of the MOCC facility, just before it discharges to the river.

Along each of these profiles, sampling points will be placed directly downgradient of potential source areas on the basis of site operations or documented releases. Combined, the three profiles will provide a map of current water quality in the upper aquifer beneath the upland portion of the site. Comparison of water quality at upgradient or mid-facility points and the downgradient points can be used to assess attenuation of detected chemicals. If it is determined that water quality in the upper aquifer does not pose a risk to the river (see Section 3.5), then no further work is proposed as part of this focused RI. If, however, COPCs are detected at levels of concern, then further site characterization, possibly including source area investigation, would be proposed in a second phase of RI site characterization.

3.4.2 Surface Water and Sediments

For upland stormwater, the approach is to collect water and sediment samples at a number of catchbasins representative of stormwater that flows from the site to the river. If COPCs are detected at levels of concern (see Section 3.5), then the stormwater drainage basins that flow to the catchbasin will be examined to isolate the source of contaminants. Another phase of RI stormwater testing may be proposed to positively identify potential source areas and determine adequate controls at the source. In addition to catchbasins, one sediment sample will be collected along the Willamette River shore, where the outfall for stormwater catchbasin S-3 is exposed at low river levels (RS-O3). Sediment quality at this sampling point would be presumably indicative of stormwater discharges from the site.

3.5 Preliminary Data Screening and Assessment

Analytical data from the Geoprobe groundwater samples and existing monitoring wells will be screened as part of initial ecological risk assessment activities. The ecological risk assessment will be performed in a tiered manner consistent with DEQ guidance. An initial risk screening step will compare measured concentrations of COPCs in groundwater near source areas to DEQ level 2 screening benchmark values protective of aquatic biota. This is a conservative screen because it assumes aquatic biota are in direct contact with the most impacted groundwater at the site. To better evaluate potential current risks, waterborne chemical concentrations from groundwater samples collected near the river also will be compared to screening values.

If this risk screen identifies chemicals of potential ecological concern, IT will estimate chemical concentrations at the groundwater discharge boundary in the river, where aquatic biota may contact chemicals. This estimate may involve the use of fate and transport models to simulate migration of chemicals in groundwater. The modeling approach and assessment methods would be presented to DEQ in a workplan before this task is implemented.

Following completion of the proposed site characterization phase, results of the preliminary screening assessment will be provided to the DEQ in a status report and associated status meeting. The purpose of the status meeting will be to discuss investigation findings and results of the preliminary screening, and if necessary, develop a plan for subsequent assessment and characterization tasks required to conclude RI activities.

Further site characterization objectives or tasks potentially could include:

- Determining the nature and extent of soil impacts in source areas identified in phase one.
- Better defining the vertical and horizontal extent of site groundwater impacts.
- Installing additional groundwater monitoring wells on the basis of reconnaissance groundwater testing.

4.0 SCOPE OF WORK

The scope of work consists of a set of task designed to further characterize site hydrogeology, groundwater and surface water quality, manage data, evaluate land and water use in the locality of the facility, and assess ecological risks.

4.1 Characterize Site Hydrogeology and Groundwater Quality

The following field activities are proposed to characterize the site hydrogeology and groundwater quality. This data will augment findings from earlier site investigations and will be used to refine the conceptual hydrogeologic model for the site. Field procedures and analytical testing schedules are explained in the SAP (Appendix A of this document). The QAPP (Appendix B) defines data quality objectives, lists chemicals to be tested, and identifies the preferred analytical methods and reporting limits for analyzing environmental samples.

4.1.1 Test Boring Program

Twenty Geoprobe test borings will be advanced to assess the groundwater quality of the upper aquifer at the site. Sampling locations are shown in Figure 2-4. As described in Section 3.4.1, sampling locations were selected to test whether (1) chemicals are migrating to the site from upgradient sources, (2) potential source areas exist on site, or (3) chemicals are discharging from groundwater to the Willamette River. The rationale for each of the probe locations is shown in Table 3-1. In addition to the Geoprobe water quality test borings, two additional borings will be drilled and completed as piezometers in the event that a pumping test is needed in future data acquisition activities.

4.1.1.1 Borehole Sampling

Soil will be logged at each of the sampling locations to provide information on lithology and to better characterize hydrogeologic units. Samples of aquifer material will be collected from approximately half of the borings and tested for grain size analysis and total organic carbon. This information will be used in estimating aquifer parameters and in modeling the fate and transport of chemicals in the upper aquifer.

Soil samples collected from the unsaturated zone will be examined for lithology as well as for visual evidence of chemical impacts. Lithologic logs will note the depth of visual impacts. Samples with obvious contamination will be tested in the laboratory for VOCs, TPH, and PAHs to screen for degree of impact.

4.1.1.2 Reconnaissance Groundwater Sampling

A groundwater sample will be collected from each test boring to evaluate the distribution of COPCs within the upper aquifer. The samples will be tested for the chemicals listed in Table 4-2. Before the field crew is mobilized, the depth of the groundwater sampling interval will be estimated using current water table elevation data. Approximately one week before sampling, the depth to water will be measured and groundwater elevations contoured for the site. Groundwater elevations will be compared to surface elevations at each boring location to provide an approximate depth to the water table. Sampling procedures are described in the SAP.

4.1.1.3 Temporary Piezometer Installation

Two of the test borings will be converted to temporary piezometers. The piezometers would function as observation wells should a pumping test be necessary to better characterize aquifer parameters. Installation during the Geoprobe investigation was considered a cost-effective means to provide for future characterization, should it be required in the future. The piezometers will be installed within a distance of approximately 10 feet of monitoring wells EX-3 and EX-6, which would serve as the pumping wells during short-term aquifer tests. The elevation of the screened interval at each piezometer will be similar to the equivalent interval at the monitoring well. If tested, the two wells would provide hydraulic conductivity information at the downgradient edge of the site (EX-3) and in the central part of the site downgradient of a potential source area (EX-6).

4.1.2 Monitoring Well Sampling

Existing monitoring wells will be sampled twice (once during high and once during low groundwater conditions) and analyzed for the constituents listed in Table 4-2. Locations of the monitoring wells complement (i.e., are spaced evenly between the test borings) the Geoprobe groundwater sample locations. Samples will be collected within one week of collecting samples from the Geoprobe borings so that water quality at all points adequately represents the spatial distribution of chemicals in groundwater unaffected by groundwater movement. Sampling procedures are described in the SAP.

4.1.3 Analytical Testing

The rationale for the laboratory testing program is discussed in Section 2.4. The Geoprobe groundwater samples and the monitoring well samples will be tested for chlorinated VOCs, TPH, four SVOCs, and light and heavy PAHs. Selected sampling points downgradient and upgradient of the former CCA production area also will be tested for dissolved chromium, copper, and arsenic. Soil samples with visual evidence of impact will be tested for chlorinated VOCs, TPH, and PAHs. If more than one soil sample from a borehole has visual evidence of impacts, one sample with the potentially highest apparent impact will be tested. Analytical methods were selected to provide method reporting limits suitable for assessing risk. Information on the proposed analytical methods and data quality objectives are provided in the QAPP.

4.1.4 Water Level Monitoring

Depth-to-water will be measured monthly for one year in site wells and piezometers, and at a point on the dock to measure river stage. Groundwater depth will be measured manually with an electronic sounder to the nearest 0.01 foot from a mark at the top of the casing. Depth will be converted to a elevation relative to mean sea level and stored in an electronic database. Water level data will evaluated for horizontal gradients and seasonal fluctuations in groundwater levels.

4.1.5 Hydraulic Testing

Field hydraulic testing, consisting of falling-head and rising-head tests (slug tests), is proposed to estimate the hydraulic properties of the upper aquifer. Up to four monitoring wells, located in different areas of the site, will be tested to provide a range of hydraulic conductivity. Two of the wells are completed in fill (EX-5 and EX-6) and two completed in alluvium (EX-7 and MW-4). The data will be evaluated using conventional analytical techniques as appropriate (e.g., Bouwer and Rice, 1976; Hvorslev, 1951; or Cooper, Bredehoeft, and Papadopulos, 1967).

4.2 Catch Basin Stormwater and Sediments

The purpose of sampling stormwater and sediments is to evaluate whether site contaminants are being transported to the Willamette River via this pathway. Stormwater and sediments will be collected from 3 catchbasins, S-1, S-2, and S-3, which were selected to be consistent with points sampled under the facility's stormwater discharge permits. These basins are collection points for surface drainage of upland areas before the stormwater discharges through storm drains to the Willamette River. Table 4-3 describes the approximate facility operational areas that drain to each sampling location. Sediment also will be collected at the outfall for S-3, where it is exposed along the shore of the Willamette River during low river level.

In addition to the catch basins, stormwater will be collected as it discharges from the oil-water separator (location S-4) for the MOCC marine terminal.

Because stormwater samples can not be collected until there is significant rainfall, sampling will not occur until late fall or early winter, when sampling can be reliably coordinated with a rainfall event. The catchbasin sediment and stormwater samples will be tested for the parameters shown in Table 4-2.

4.3 Data Management and Evaluation

Data will be managed in a format appropriate for evaluation in an exposure assessment. Raw data from the field or from the laboratory will be reviewed for acceptability and entered into a computerized database, consistent with IT Corporation data management procedures (see the QAPP).

Analytical data will be reviewed to assess whether they meet project-specific data quality objectives. Review will be based on accepted USEPA procedures for evaluating data. On completion of data review, a report will be prepared to support specific or routine report deliverables. Data quality assurance and quality control (QA/QC) procedures for the project are described in the QAPP.

4.4 Land and Water Use

Land and water use determinations for the site will be made consistent with current DEQ guidance (1998a,b). Both of these determinations depend on a delineation of the locality of the facility (LOF). This is defined as any point where a human or an ecological receptor contacts or is reasonably likely to come in contact with facility-related hazardous substances. The LOF also takes into account the likelihood of the contamination migrating over time.

Because the facility borders the Willamette River, which is the regional hydrogeologic discharge boundary, a preliminary designation for the LOF is the current facility property boundary. The present conceptual hydrogeologic model indicates that site groundwater discharges to the Willamette River at the river edge property boundary.

4.4.1 Land Use

The site upland is included in the Willamette Greenway established by the City of Portland to monitor and control land use next to the river. The site upland and surrounding properties are zoned for heavy industrial use, both within the Greenway on the left bank and outside of the Greenway. Surrounding industries include: petroleum bulk distribution terminals, chemical plants, sand and gravel operations, a steel fabrication facility, shipyards, and rail yards. Reasonably likely future uses are expected to remain heavy industrial for the foreseeable future. As part of the focused RI, the following information will be gathered to support classification of land use expected in the future:

- Confirmation of current and reasonably likely future use, both general zoning use and specific activity use, on the properties within the LOF.

- Zoning map, comprehensive plan designation, and any applicable regulations as provided by the City of Portland.

- Other relevant documentation about inquiries made regarding the presence of any regional trends relevant to land use within the LOF.

Land use conclusions along with supporting documentation will be provided in the RI report.

4.4.2 Beneficial Water Use

Both groundwater and stormwater within the LOF discharge to the Willamette River. The shallow aquifer is not used for drinking water at the site because the facility is supplied by municipal water. The nearest water supply well is located on an adjacent upgradient property owned by Chevron USA. It is presumed to be used for industrial purposes (EMCON, 1994b). As of 1994, eight other water supply wells within a one-mile radius had been registered with the Oregon Water Resources Department (WRD). According to WRD records, these were used for industrial or dewatering purposes.

The evaluation of beneficial uses of water within the LOF is relatively streamlined given that the primary purpose of the focused RI is to evaluate potential migration of site-related contaminants to the Willamette River, and that the LOF is limited to the site property boundary. Drinking water is not a reasonably likely current or future beneficial use of water in the LOF because the facility has a municipal supply. On this basis, a preliminary beneficial water use determination for the LOF includes two general categories: Willamette River aquatic life and recreational uses associated with the Willamette River.

This preliminary determination will be reviewed as part of the focused RI scope of work, and revised as appropriate. Information to be discussed and provided in the RI report may include updated well records from the WRD, maps showing extent of surface water bodies, wetlands, or sensitive environments, or other information relevant to water use described in Section 4.5. In the beneficial water use determination, the RI report will consider the following factors: historic land and water use; anticipated future land and water use; regional and local development patterns; regional and local population projections; and availability of alternate water sources.

4.5 Level 1 Scoping Assessment

The DEQ recommends a tiered process to evaluate potential risks that chemical releases may pose to the environment (DEQ, 1998c,d). The first phase of the ecological risk evaluation is a Level I - Ecological Scoping Assessment (DEQ, 1998c). The purpose of the ecological scoping assessment is to determine if important ecological receptors can be exposed to site-related chemicals. If results of the scoping assessment indicate that there are no significant pathways by which important ecological receptors could contact site-related chemicals, no further ecological evaluations would be performed. However, if there are complete pathways by which ecological receptors can contact site-related chemicals, higher tiered ecological risk assessments are performed, such as a Level 2 – Ecological Screening Assessment (DEQ, 1998d). As part of the site characterization elements of the RI, an ecological scoping assessment will be performed. Any subsequent risk assessments would be described in a risk assessment workplan.

As mentioned above, the objective of the scoping assessment is to determine if important ecological receptors could be exposed to site-related chemicals. According to DEQ guidance (DEQ, 1998c,d), the following are considered ecologically important species for the purposes of a Scoping Assessment:

- Threatened or endangered species
- Local populations of species that are commercial or recreational resources
- Local populations of species known to be susceptible to site-related chemicals
- Local populations of vertebrate species
- Local populations of invertebrate species that provide a critical ecological function

Based on a preliminary review of site conditions, results of the scoping assessment likely will indicate that ecological receptors such as benthic invertebrates in the Willamette River may be exposed to site-related chemicals if these chemicals migrate to the river. Even though some outcomes of the scoping assessment are already known, the assessment will be completed to better describe species of special concern (i.e., endangered species) that may be present at the site, the ecological setting, and the pathways by which various receptors may be exposed. The scoping assessment will involve the following activities:

4.5.1 Site visit

An ecologist from IT will visit the site and describe the ecological setting. Both upland and aquatic habitat conditions will be described and photographed. Ecological checklists presented in DEQ guidance (DEQ, 1998c) will be completed. Also, an informal survey of ecological receptors at or near the site will be performed. The purpose of the survey is to describe the types of likely ecological receptors at the site, but no quantitative abundance or species diversity estimates will be performed.

4.5.2 *Sensitive environments*

According to OAR 340-122-115(49), ecologically sensitive environments include: critical habitat to endangered or threatened species, wetlands, wild and scenic rivers, fishery resources, parks, wildlife refuges and a number of other habitat designations. Maps and other resources will be reviewed to catalog sensitive environments near the site.

4.5.3 *Species of Special Concern*

Several information sources will be reviewed to identify species at the site that have been classified by either the Oregon Department of Fish and Wildlife (ODFW) or the U.S. Fish and Wildlife Service (USFWS) as "sensitive," "threatened," or "endangered." Species classified as "sensitive" by the ODFW are ones for which insufficient data are available to determine their status, or are known to be declining in abundance. Species classified as "threatened" or "endangered" receive special protection under the Endangered Species Act. Range maps and natural history information for Oregon vertebrates that are thought to be rare, declining, or of special concern will be reviewed (Marshall, Chilcote, and Weeks, 1996). Recent lists of state or federal threatened and endangered species will be reviewed to determine if species of special concern may be present at the site. Also, biologists from the ODFW will be contacted to identify sensitive species that may be present at the site.

4.5.4 *Exposure pathways*

Pathways by which important ecological receptors may be exposed to site-related chemicals will be identified and described. The completed pathways will determine the nature of the subsequent screening assessment. For example, it is known that ecological receptors are present in the adjacent Willamette River. As a result, a screening assessment will include an assessment of risks that chemicals in groundwater may pose to organisms of the river if impacted groundwater were to migrate to the river.

5.0 REPORTING

Reporting for the focused RI consists of quarterly reports to advise the DEQ of ongoing and planned site activities, and draft and final reports. As the focused RI work progresses, preliminary findings and interpretations may be submitted to the DEQ through interim status reports, at the discretion of MOCC/GWCC.

5.1 Quarterly Reports

Two copies of each quarterly report will be submitted to the DEQ by the 15th day of the quarter following the reporting period. The quarterly reports will include the following information:

- Description of activities performed during the reporting period
- Summary of new data
- Description of problem(s) encountered during the reporting period and or corrective actions taken
- Activities planned for the upcoming quarter

5.2 Interim Status Report

An interim status report may be prepared after the reconnaissance groundwater sampling and the preliminary ecological risk screening has been completed. The purpose of the status report would be to develop preliminary conclusions about overall groundwater quality in the upper aquifer and whether constituents detected are at concentrations to warrant either further site characterization, fate and transport modeling, or ecological risk assessment. A meeting could be scheduled with the DEQ after submitting the status report to discuss the report's findings and recommendations.

5.3 Focused RI Report

A draft RI report documenting the investigation's findings will be submitted after completing site characterization activities and data interpretation. The report will include the following elements:

- Executive summary
- Introduction
- Site background

- Study area investigation
- Summary and conclusion

The report will be supported by necessary tables, figures, and appendices to provide detailed information. Following review and comments by the DEQ, the report will be revised and a final RI report will be submitted. Two bound copies of the report will be submitted to the DEQ. Where possible, the report will be double-sided on recycled paper.

6.0 PROJECT MANAGEMENT PLAN

6.1 Schedule

The tentative schedule for the focused RI is show on Figure 6-1. The schedule assumes standard laboratory turnaround times and approvals of the RI workplan consistent with those specified in Section I of the SOW. The schedule for future deliverables specified in the SOW (e.g., risk assessment workplan, focused RI report, risk assessment report) are tied to planned dates for completing work shown on the Gantt chart.

Because of the unpredictable nature of site characterization and assessment activities, the schedule needs to remain flexible. Field activities will depend on contractor availability, weather, and field conditions. Workplans may be amended as necessary to reflect or incorporate newly discovered information or environmental conditions. Changes in schedule will be negotiated between the parties at the time of each phase change or task addition.

The proposed schedule for deliverables to DEQ through the beginning of field activities is as follows:

Draft Focused RI Workplan	Friday, September 15
DEQ Provides Comment on RI Workplan	Friday, October 13
Submit Final Focused RI Workplan	Friday, November 17
Begin Focused RI Scope of Work	Week of December 4
Interim Status Report	February 2, 2001

6.2 Project Team and Organization

A project organization chart is shown in Figure 6-2. IT will work at the direction of MOCC/GWCC, and will perform the tasks outlined in this workplan.

The following describes key personnel roles in the project. Subcontractors have not been identified at this time, but will be qualified on the basis of past performance on IT projects.

Lee Zimmerli will be the project coordinator for MOCC/GWCC. He will be in charge of all RI activities. Mr. Zimmerli will be kept informed of the status of the project and of project activities. He will be involved in discussions with the DEQ, or will delegate that responsibility to IT Corporation. Mr. Zimmerli will direct IT in the coordination of site activities with facility personnel.

John Edwards will be the project director for IT. Mr. Edwards will coordinate with the project manager and communicate regularly with Mr. Zimmerli and DEQ personnel. He will review all data, reports, and other project-related documents prepared by IT before submittal to MOCC/GWCC or the DEQ. Mr. Edwards also will assist task leaders with technical issues.

Eric Tuppan will be responsible for managing the overall completion of the focused RI (consistent with the procedures and guidelines described in the workplan, SAP, QAPP, and health and safety plan) and for regular communication of project status to the project director and the MOCC/GWCC project coordinator. Mr. Tuppan will provide technical assistance to the assigned project geologist, data manager, and health and safety officer, as appropriate; assist with resolution of technical or logistical challenges that may be encountered during the RI; write and review reports; and participate in discussions with the DEQ.

Jeff Peterson will conduct the risk assessment. To verify that data collected during the RI can be effectively applied in this assessment, he will be involved with overall data management. Dr. Peterson will work with the IT QA/QC officer and other assigned staff to see that the data are validated consistent with the guidelines in the QAPP. He will oversee data entry into a database and work with the project manager to assign staff, as appropriate, to assist with data reduction.

John Renda will be the task leader directing the site characterization. Mr. Renda will be responsible for implementing the workplan, including overseeing the test boring program, supervising field sampling personnel, aquifer testing, managing and evaluating data, and preparing reports.

Patrick Moore will be the IT health and safety officer. He will provide technical assistance to resolve any health and safety issues that arise. Mr. Moore may audit fieldwork to ensure compliance with health and safety procedures.

6.3 Variations from Approved Workplan

Variations from an approved workplan will be handled in one of two ways. For changes that can be anticipated well in advance, proposed changes will be documented in either an email or short letter amendment and submitted to the DEQ for review and comment. The letter or email will specify a turnaround time for DEQ review if timely response is required to maintain scheduled activities.

For changes that occur in the field due to adverse field conditions, equipment malfunction, or other unforeseen circumstances, modifications will be noted in a field book and communicated to the IT project manager and MOCC/GWCC coordinator. This information will then be passed on to the DEQ project manager through either the IT or MOCC/GWCC project coordinator.

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TABLES

Table 2-1

Monitoring Well Hydrology Measurements

McCall Oil and Chemical Corporation
Focused RI Workplan

Well	Reference Point Elevation (Feet MSL)	Date	DTW (Feet)	WLE (Feet MSL)
EX-1	36.12	09/08/94	15.35	20.77
		12/29/94	14.60	21.52
		03/29/95	13.06	23.06
		06/27/95	13.65	22.47
		07/14/95	13.82	22.30
		05/01/97	12.71	23.41
		02/03/99	13.21	22.91
EX-2	32.28	09/08/94	18.56	13.72
		12/29/94	17.87	14.41
		03/29/95	17.11	15.17
		06/27/95	17.27	15.01
		07/14/95	17.42	14.86
		05/01/97	13.08	19.20
		02/03/99	16.30	15.98
EX-3	32.07	09/08/94	17.96	14.11
		12/29/94	16.72	15.35
		03/29/95	15.43	16.64
		06/27/95	15.91	16.16
		07/14/95	15.96	16.11
		05/01/97	12.84	19.23
		02/03/99	15.12	16.95
EX-4 (MW-2)	35.60	10/18/93	16.63	18.97
		10/28/93	16.72	18.88
		01/27/94	16.56	19.04
		09/08/94	16.86	18.74
		12/29/94	16.09	19.51
		03/29/95	14.63	20.97
		06/27/95	15.22	20.38
		07/14/95	15.41	20.19
		05/01/97	14.08	21.52
		02/03/99	14.58	21.02
EX-5	31.87	09/08/94	NM	
		12/29/94	15.85	16.02
		03/29/95	14.84	17.03
		06/27/95	16.32	15.55
		07/14/95	16.34	15.53
		05/01/97	12.06	19.81
		02/03/99	13.45	18.42
EX-6	34.38	09/08/94	NM	
		12/29/94	13.98	20.40
		03/29/95	12.51	21.87
		06/27/95	13.04	21.34
		07/14/95	13.17	21.21
		05/01/97	11.93	22.45
		02/03/99	12.71	21.67

Table 2-1

Monitoring Well Hydrology Measurements

McCall Oil and Chemical Corporation
Focused RI Workplan

Well	Reference Point Elevation (Feet MSL)	Date	DTW (Feet)	WLE (Feet MSL)
EX-7	35.29	09/08/94	NM	
		12/29/94	13.21	22.08
		03/29/95	11.69	23.60
		06/27/95	12.34	22.95
		07/14/95	12.38	22.91
		05/01/97	11.44	23.85
		02/03/99	11.81	23.48
MW-1	35.48	05/11/93	15.56	19.92
		10/18/93	17.04	18.44
		10/28/93	17.16	18.32
		01/27/94	16.99	18.49
		09/08/94	NM	
		12/29/94	16.43	19.05
		03/29/95	NM	
		06/27/95	NM	
		07/14/95	NM	
		05/01/97	14.12	21.36
		02/03/99	14.83	20.65
MW-3	34.56	10/18/93	16.47	18.09
		10/28/93	16.60	17.96
		01/27/94	16.40	18.16
		09/08/94	NM	
		12/29/94	15.90	18.66
		03/29/95	NM	
		06/27/95	NM	
		07/14/95	NM	
		05/01/97	13.73	20.83
		02/03/99	14.36	20.20
MW-4	33.61	10/18/93	16.21	17.40
		10/28/93	16.26	17.35
		01/27/94	16.06	17.55
		09/08/94	NM	
		12/29/94	15.55	18.06
		03/29/95	NM	
		06/27/95	NM	
		07/14/95	NM	
		05/01/97	13.32	20.29
		02/03/99	14.04	19.57
MW-5	34.66	10/18/93	20.13	14.53
		10/28/93	20.48	14.18
		01/27/94	19.89	14.77
		09/08/94	NM	
		12/29/94	19.25	15.41
		03/29/95	NM	
		06/27/95	NM	
		07/14/95	NM	

Table 2-1

Monitoring Well Hydrology Measurements

McCall Oil and Chemical Corporation
Focused RI Workplan

Well	Reference Point Elevation (Feet MSL)	Date	DTW (Feet)	WLE (Feet MSL)
		05/01/97	15.91	18.75
		02/03/99	18.15	16.51
WG-1	37.28	10/28/93	32.82	4.46
		01/27/94	30.04	7.24
		09/08/94	NM	
		12/29/94	NM	
		03/29/95	NM	
		06/27/95	NM	
		07/14/95	NM	
		05/01/97	17.80	19.48
		02/03/99	23.02	14.26

Note: Reference point elevations surveyed by WHP on September 19, 2000.

Table 2-2

Well Construction Information

McCall Oil and Chemical Corporation
Focused RI Workplan

Monitoring ocation	Northing[c]	Easting[c]	Ground Surface Elevation (ft MSL)	Reference Point Elevation[a] (ft MSL)	Total Depth Boring (ft bgs)	Total Depth Casing (ft bgs)	Screened Interval (ft bgs)	Filter Pack Interval (ft bgs)	Filter Pack Interval (ft MSL)	Seal (ft bgs)	Borehole Diameter (inches)	Well Diameter (inches)	Drilling Method[b]	Date Well Installed	Lithology
EX-1	10,085.54	4,249.63	36.4	36.12	25.0	24.0	9.0-24.0	7.0-24.0	12.4-29.4	0-7.0	10	2	HSA	09/06/1994	Fill/Sand
EX-2	10,558.45	4,883.51	33.1	32.28	25.5	25.0	10.0-25.0	8.0-25.0	8.1-25.1	0-8.0	10	2	HSA	09/06/1994	Fill/Sand
EX-3	10,884.03	4,568.18	32.3	32.07	26.0	24.5	9.5-24.5	7.5-24.5	7.8-22.8	0-7.5	10	2	HSA	09/06/1994	Fill/Sand
EX-4 (MW-2	10,459.15	3,767.04	35.9	35.60	28.0	27.8	17.5-27.1	15.5-27.8	8.1-20.4	0-15.5	10	2	HSA	10/01/1993	Fill/Sand
EX-5	10,932.87	4,201.79	32.1	31.87	24.0	24.0	8.8-23.3	6.8-24.0	8.1-25.3	0-6.8	10	2	HSA	12/19/1994	Fill/Sand
EX-6	10,295.28	4,299.65	34.8	34.38	25.0	24.7	9.6-24.0	9.6-24.7	10.1-25.2	0-7.6	10	2	HSA	12/19/1994	Fill/Qal
EX-7	9,860.73	4,158.27	35.9	35.29	25.3	25.3	10.0-24.6	8.2-25.3	10.6-27.7	0-8.2	10	2	HSA	12/19/1994	Qal-SP
MW-1	10,531.66	3,883.20	35.7	35.48	21.5	19.5	9.5-19.5	7.0-21.5	14.2-28.7	0-7.0	8	2	HSA	06/13/1990	Fill-SM
MW-3	10,606.91	3,812.94	35.3	34.56	27.5	27.5	17.3-26.8	15.0-27.5	7.8-20.3	0-15.0	10	2	HSA	10/04/1993	SP-ML
MW-4	10,694.29	3,806.68	34.1	33.61	28.2	28.2	18.0-27.5	16.0-28.2	5.9-18.1	0-16.0	10	2	HSA	10/01/1993	SP-SM-ML
MW-5	10,840.05	3,669.24	35.0	34.66	35.5	35.5	25.2-34.8	22.5-35.5	-0.5-12.5	0-22.5	10	2	HSA	09/30/1993	Qal-ML
WG-1(River)	—	—	—	37.28	—	—	—	—	—	—	—	—	—	—	—

NOTE:

[a] Surveyed top of PVC well casing by WHP, September 2000. Elevation based on City of Portland Benchmark #2528. Elevation = 34.64.

[b] Hollow stem auger.

[c] Horizontal coordinates based on assumed local plane.

Table 2-3
Groundwater Quality Database
McCall Oil and Chemical Corporation
Focused RI Workplan

Well	Date	TPH Diesel (µg/L)	TPH Other TPH (µg/L)	VOCs 1,1-DCE (µg/L)	VOCs TCA (µg/L)	VOCs TCE (µg/L)	VOCs PCE (µg/L)
EX-1	09/08/1994	50 U	266	7	180	160	650
	12/30/1994	50 U	632	22	290	280	2000
	03/29/1995	50 U	454	5 U	310	400	2600
	07/14/1995	50 U	200 U	5 U	76	90	980
	05/01/1997	50 U	200 U	1.8	270	470	3600
	02/04/1999	100 U	924	50 U	130	250	3000
EX-2	09/08/1994	50 U	200 U				
	12/30/1994	50 U	441	5 U	5 U	5 U	5 U
	03/29/1995	50 U	398	5 U	5 U	5 U	5 U
	07/14/1995	50 U	885	5 U	5 U	5 U	5 U
	05/01/1997	519	200 U	0.5 U	0.5 U	0.5 U	0.5 U
	02/04/1999	10 U	569	0.5 U	0.5 U	0.5 U	0.5 U
EX-3	09/08/1994	50 U	200 U				
	12/30/1994	50 U	200 U	5 U	5 U	5 U	5 U
	03/29/1995	50 U	474	5 U	5 U	5 U	5 U
	07/14/1995	50 U	226	5 U	5 U	5 U	5 U
	05/01/1997	64	200 U	0.5 U	0.5 U	0.5 U	0.5 U
	02/04/1999	100 U	564	0.5 U	0.5 U	0.5 U	0.5 U
EX-4	09/08/1994	50 U	200 U				
(MW-2)	12/30/1994	1000 U	3840	5 U	5 U	5 U	5 U
	03/29/1995	2140	200 U	5 U	5 U	5 U	5 U
	07/14/1995	343	200 U	5 U	5 U	5 U	5 U
	05/01/1997	1310	200 U	0.5 U	0.5 U	0.5 U	0.5 U
	02/04/1999	100 U	787	0.5 U	0.5 U	0.5 U	0.5 U
EX-5	12/30/1994	50 U	1400	5 U	5 U	5 U	5 U
	03/29/1995	50 U	767	5 U	5 U	5 U	5 U
	07/14/1995	1500	200 U	5 U	5 U	5 U	5 U
	05/01/1997	50 U	415	0.5 U	0.5 U	0.5 U	0.5 U
	02/04/1999	100 U	573	0.5 U	0.5 U	0.5 U	0.5 U
EX-6	12/30/1994	50 U	851	5 U	5 U	5 U	5 U
	03/29/1995	50 U	1160	5 U	5 U	5 U	5 U
	07/14/1995	50 U	200 U	5 U	5 U	5 U	5 U
	05/01/1997	50 U	1450	1	0.5 U	2.6	0.7
	02/04/1999	100 U	1280	0.5 U	0.5 U	0.5 U	0.5 U
EX-7	12/30/1994	50 U	200 U	5 U	5 U	5 U	5 U
	03/29/1995	50 U	200 U	5 U	5 U	5 U	5 U
	07/14/1995	50 U	200 U	5 U	5 U	5 U	5 U
	05/01/1997	50 U	200 U	0.5 U	0.5 U	0.5 U	0.5 U
	02/04/1999	100 U	250 U	0.5 U	0.5 U	0.5 U	0.5 U

Table 2-3
Groundwater Quality Database
McCall Oil and Chemical Corporation
Focused RI Workplan

Well	Date	TPH Diesel (µg/L)	TPH Other TPH (µg/L)	VOCs 1,1-DCE (µg/L)	VOCs TCA (µg/L)	VOCs TCE (µg/L)	VOCs PCE (µg/L)
MW-1	05/01/1997	319	200 U	0.9	8	28	110
	02/04/1999	100 U	250 U	0.5 U	0.5 U	0.5 U	1.7
MW-3	05/01/1997	1430	200 U	0.5 U	0.5 U	0.5 U	0.5 U
	02/04/1999	100 U	1190	0.5 U	0.5 U	0.5 U	0.5 U
MW-4	05/01/1997	312	200 U	0.5 U	0.5 U	8.1	11
	02/04/1999	100 U	716	0.5 U	0.5 U	2	2.5
MW-5	05/01/1997	204	200 U	0.5 U	0.5 U	0.5 U	0.5 U
	02/04/1999	100 U	391	0.5 U	0.5 U	0.5 U	0.5 U

Notes: U=Not detected at or above the method reporting limit.
Other=Lube oil or other petroleum hydrocarbon outside the typical range.
1,1-DCE=1,1=Dichloroethene
TCA=1,1,1-Trichloroethane
TCE=Trichloroethene
PCE=Tetrachloroethene

Table 4-1

Groundwater Sampling Rationale

McCall Oil and Chemical Corporation
Focused RI Workplan

Potential Source Area	Sampling Locations	Chemical Class Tested [a]	Rationale
McCall Oil & Chemical Corp.			
Diesel rack (marine terminal)	EX-2, GP-20	VOCs, SVOCs, PAHs, TPH	Downgradient of potential source of TPH/PAHs
Asphalt rack (asphalt plant)	GP-8	VOCs, SVOCs, PAHs, TPH	Downgradient of potential source of TPH/PAHs
Asphalt plant AST tank farm	GP-8, GP-9	VOCs, SVOCs, PAHs, TPH	Downgradient of potential source of TPH/PAHs
Railcar loading/unloading facility	GP-6, GP-7	VOCs, SVOCs, PAHs, TPH	Downgradient of potential source of VOCs and TPH/PAHs
Marine terminal AST tank farm	GP-15 to GP-20, EX-2, EX-3, EX-5	VOCs, SVOCs, PAHs, TPH	Document groundwater quality leaving site
Great Western Chemical Co.			
Railcar loading/unloading facility	GP-6, GP-7	VOCs, SVOCs, PAHs, TPH	Downgradient of potential source of VOCs and TPH/PAHs
Acid/solvent AST tank farm	EX-1, EX-6, GP-8, GP-9	VOCs, SVOCs, PAHs, TPH	Downgradient of potential source of VOCs
Drumming shed	EX-1, EX-6, GP-9, GP-10, GP-11	VOCs, SVOCs, PAHs, TPH	Downgradient of potential source of VOCs
Former CCA production area	EX-4 (MW-2), MW-1, MW-3, MW-4 GP-11, GP-12, GP-13, GP-14, GP-15	VOCs, SVOCs, PAHs, TPH Metals	Downgradient of documented source of metals. Source has been removed.
Upgradient Off-Site Source Areas	GP-1, GP-2, GP-3, GP-4, GP-5, EX-7	VOCs, SVOCs, PAHs, TPH Metals	Evaluate groundwater quality entering the site from upgradient sources

Notes: VOCs = chlorinated VOCs; SVOCs = four semivolatile organic compounds listed in workplan; PAHs = polynuclear aromatic hydrocarbons; TPH = total petroleum hydrocarbons as diesel and oil; Metals = dissoved arsenic, chromium, and copper.

[a] List of chemicals to be tested for each chemical class is shown in QAPP (Appendix B).

Table 4-2
Sampling Matrix
Focused Remedial Investigation
McCall Oil and Chemical Corporation

	Organic Compounds							Metals		
Areas	Chlorinated VOCs	4-methylphenol	Butylbenzylphthalate	Di-n-octylphthalate	Dibenzofuran	PAHs	Total Petroleum Hydrocarbons	As, Cu, Cr (Dissolved for water)	Cd, Pb, Zn (Dissolved for water)	Total Organic Carbon
Analytical Method	GC/MS	GC/MS-SIM					GC-FID	ICP-MS		ASTM
Groundwater										
Geoprobe Borings										
GP-1	X	X	X	X	X	X	X			
GP-2	X	X	X	X	X	X	X			
GP-3	X	X	X	X	X	X	X	X		
GP-4	X	X	X	X	X	X	X	X		
GP-5	X	X	X	X	X	X	X	X		
GP-6	X	X	X	X	X	X	X			
GP-7	X	X	X	X	X	X	X			
GP-8	X	X	X	X	X	X	X			
GP-9	X	X	X	X	X	X	X			
GP-10	X	X	X	X	X	X	X			
GP-11	X	X	X	X	X	X	X	X		
GP-12	X	X	X	X	X	X	X	X		
GP-13	X	X	X	X	X	X	X	X		
GP-14	X	X	X	X	X	X	X	X		
GP-15	X	X	X	X	X	X	X	X		
GP-16	X	X	X	X	X	X	X			
GP-17	X	X	X	X	X	X	X			
GP-18	X	X	X	X	X	X	X			
GP-19	X	X	X	X	X	X	X			
GP-20	X	X	X	X	X	X	X			
Monitoring Wells										
EX-1	X	X	X	X	X	X	X			
EX-2	X	X	X	X	X	X	X			
EX-3	X	X	X	X	X	X	X			
EX-4 (MW-2)	X	X	X	X	X	X	X	X		
EX-5	X	X	X	X	X	X	X			
EX-6	X	X	X	X	X	X	X			
EX-7	X	X	X	X	X	X	X			
MW-1	X	X	X	X	X	X	X	X		
MW-3	X	X	X	X	X	X	X	X		
MW-4	X	X	X	X	X	X	X	X		
MW-5	X	X	X	X	X	X	X			
Surface Water										
Stormwater Catchbasins										
S-1		X	X	X	X	X	X	X	X	
S-2		X	X	X	X	X	X	X	X	
S-3		X	X	X	X	X	X	X	X	
Oil-Water Separator										
S-4		X	X	X	X	X	X	X	X	
Sediment										
Stormwater Catchbasins										
S-1		X	X	X	X	X	X	X	X	X
S-2		X	X	X	X	X	X	X	X	X
S-3		X	X	X	X	X	X	X	X	X
Outfall from S-3										
RS-O3		X	X	X	X	X	X	X	X	X

Table 4-3

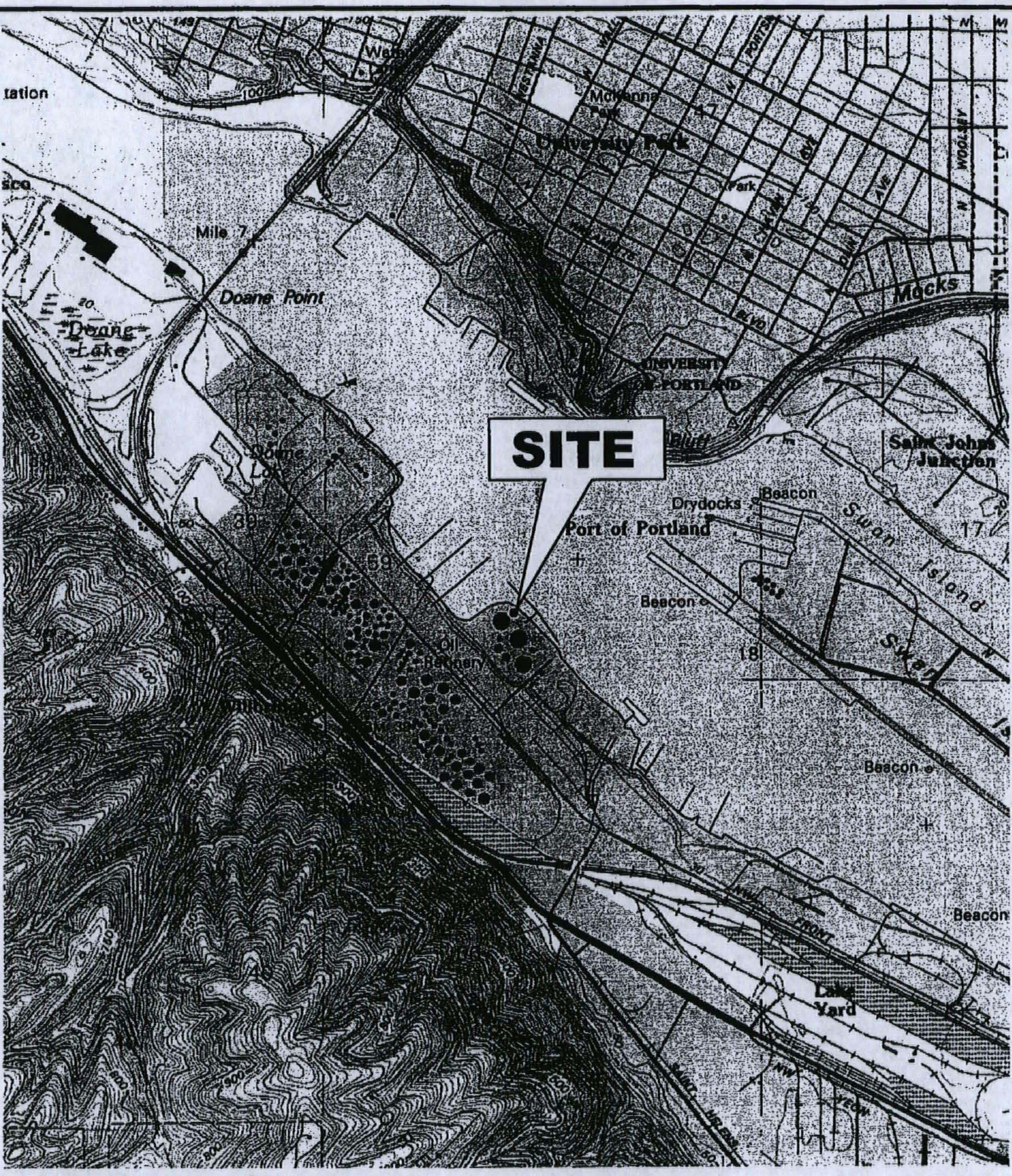
Stormwater Drainage Basins

McCall Oil and Chemical Corporation
Focused RI Workplan

Sample Designation	Type of Sampling Point	Conveyance to Willamette River	Facilities within Stormwater Drainage Basin
S-1	Catchbasin	CB discharges to storm drain on Front Ave., then to river	Paved parking lot near office, drumming shed, acid/solvent tank farm.
S-2	Catchbasin	CB discharges to storm drain on Front Ave., then to river	Paved parking lot near Technical Center office and laboratory, truck loading area,
S-3	Stormwater containment sump	Sump discharges through pipe to Willamette River	Paved parking areas, bulk chemical storage, pallet and empty barrel storage, chlorinated solvent storage, chemical truck loading rack, tank truck loading area.
S-4	Oil-Water Separator	Discharges through pipe to Willamette River	Paved and unpaved parking areas, diesel loading rack, marine terminal tank farm within containment berm.

FIGURES

IMAGE	X-REF	OFFICE	DRAWN BY	CHECKED BY	APPROVED BY	DRAWING NUMBER
		Portland	J. Clugston 9/12/2000		9/14/00	807595-A1



BASE MAP FROM: USGS 7.5' quads., Portland and Linnton, OR., (1977, 1984).

APPROXIMATE SCALE

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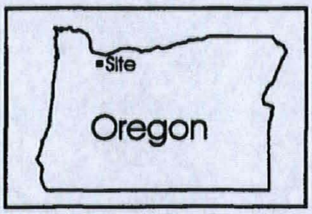
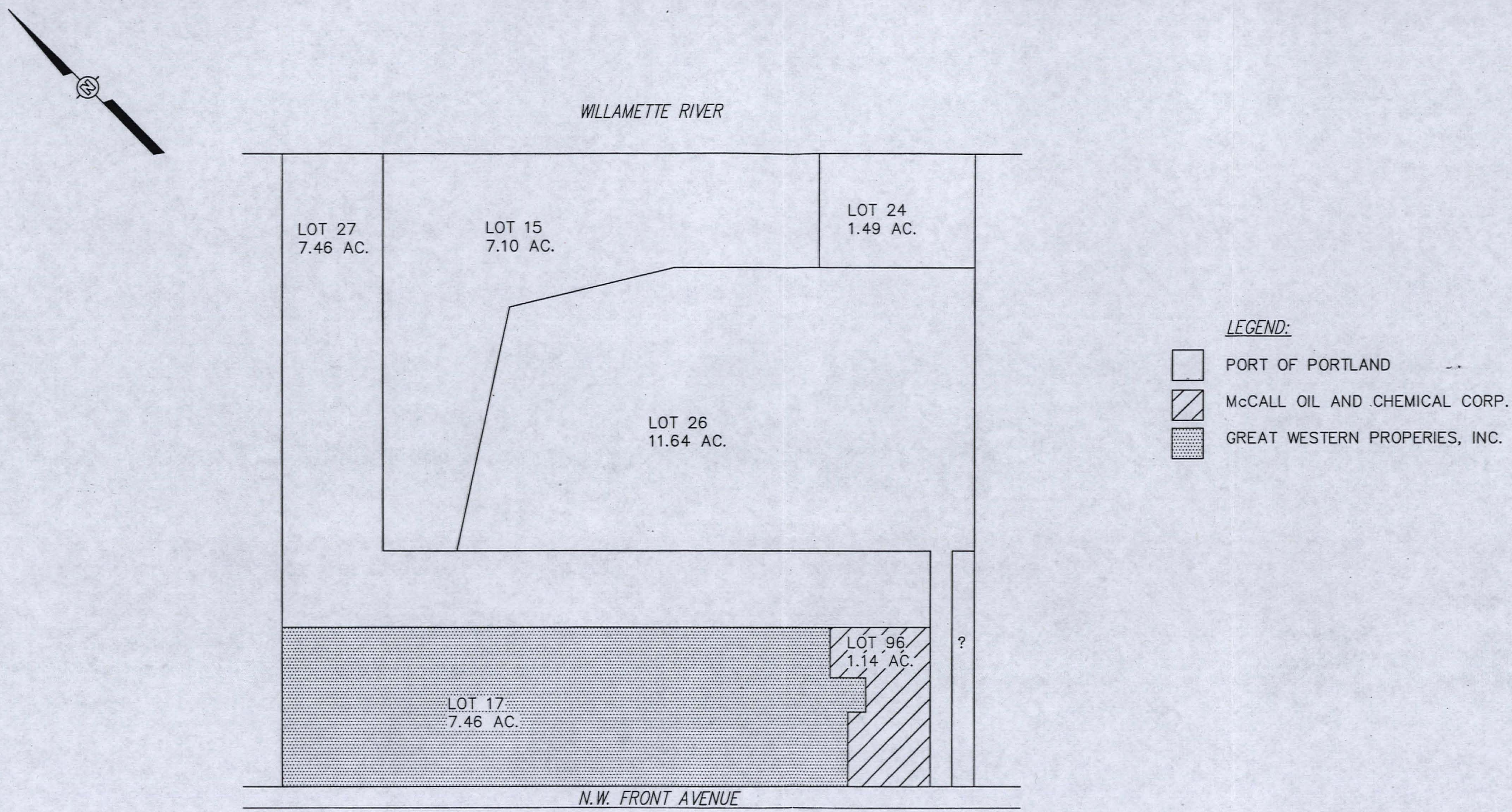


IT CORPORATION

IT CORPORATION
15055 SW SEQUOIA PARKWAY
SUITE 140
PORTLAND, OR 97224
(503)62407200 FAX (503)620-7658

FIGURE 2-1
LOCATION MAP
FOCUSED RI WORKPLAN
McCALL OIL AND CHEMICAL CORPORATION
PORTLAND, OREGON



SCALE
0 200 400 FEET

IT CORPORATION
15055 SW Sequoia Parkway
Suite 140
Portland, Oregon 97224
(503)624-7200 Fax(503)620-7658

FIGURE 2-2

SITE TAX LOT AND OWNERSHIP MAP
FOCUSED RI WORKPLAN
McCALL OIL AND CHEMICAL CORPORATION
PORTLAND, OREGON

OFFICE	DRAWN BY		CHECKED BY	APPROVED BY		DRAWING NUMBER
Portland	R. Bricker	9/12/00	ET	ET	9/14/00	807595-B1

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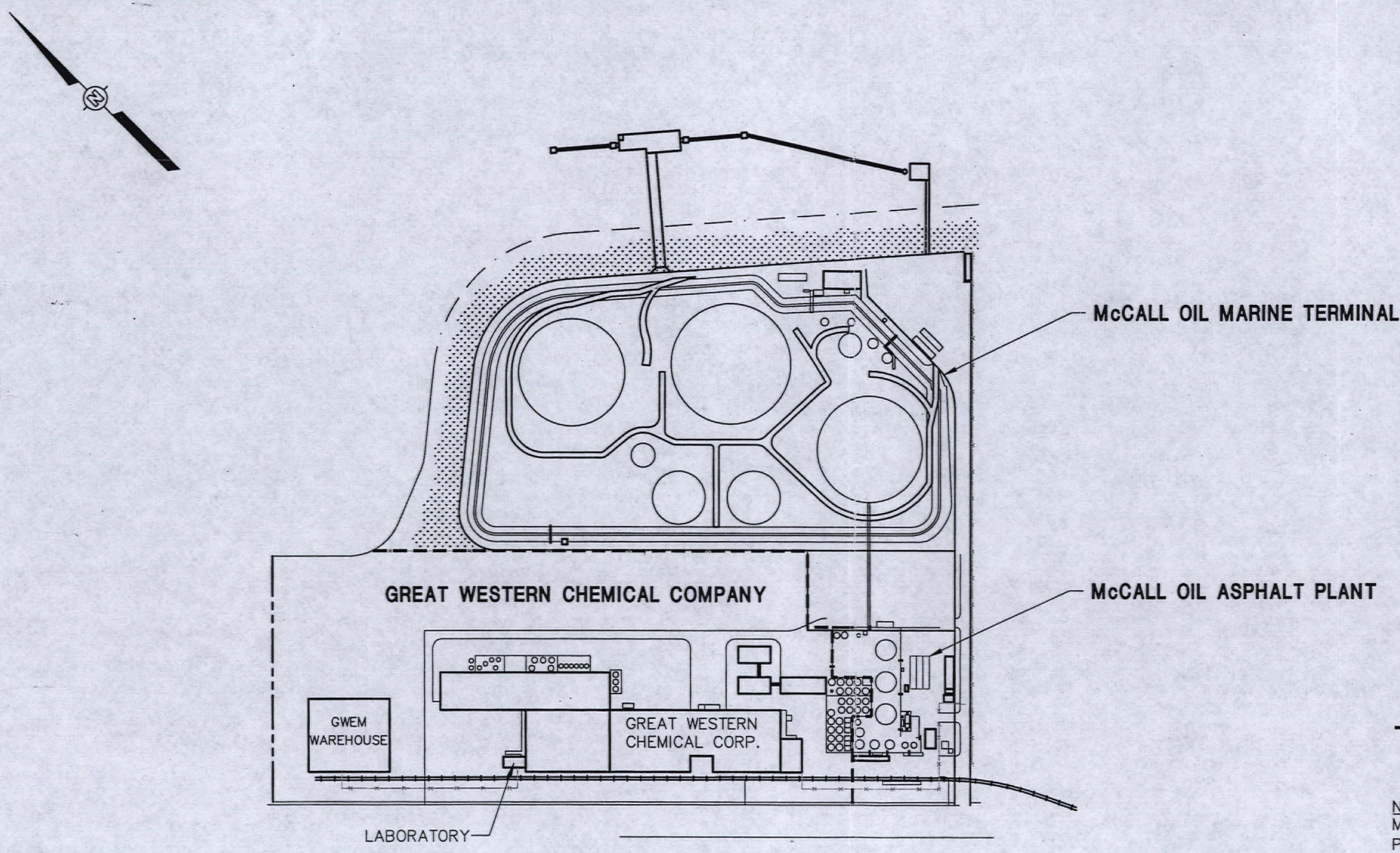

LEGEND:

- - - - McCALL OIL/GREAT WESTERN CHEMICAL PLANT BOUNDARY

NOTE:

MAP MODIFIED FROM McCALL OIL, EVACUATION PLAN, PORTLAND MARINE TERMINAL, "C-1", 8-26-93, PROJECT 1923 (1923.01\C01B.DWG)

SCALE

0 200 400 FEET

OFFICE	DRAWN BY	CHECKED BY	APPROVED BY	DRAWING NUMBER
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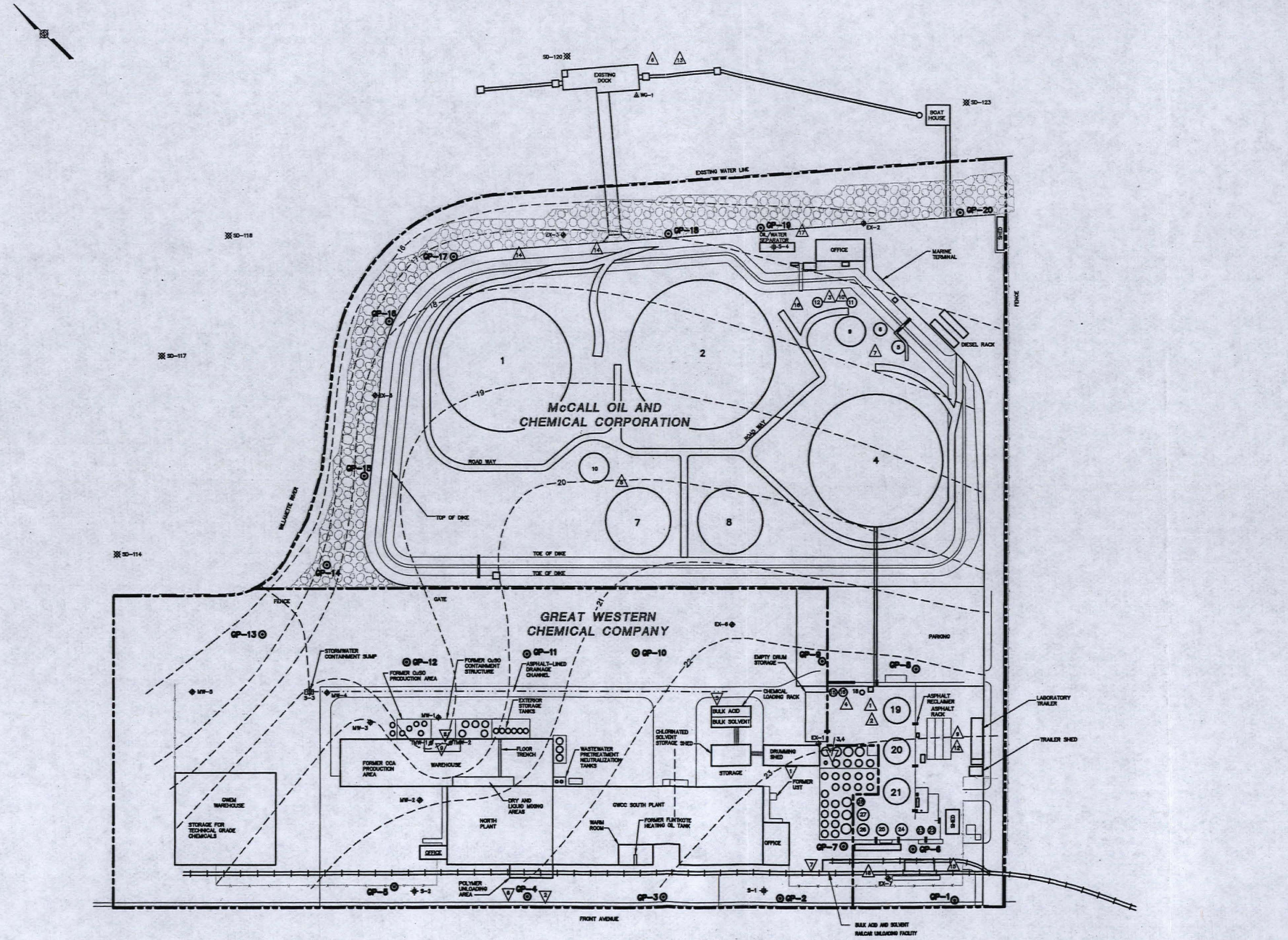
IT CORPORATION
15055 SW Sequoia Parkway
Suite 140
Portland, Oregon 97224
(503)624-7200 Fax(503)620-7658

FIGURE 2-3

SITE FACILITIES MAP
FOCUSED RI WORKPLAN

McCALL OIL AND CHEMICAL CORPORATION
PORTLAND, OREGON

OFFICE	DRAWN BY	CHECKED BY	APPROVED BY	DRAWING NUMBER
Portland	J. Clugston 9/13/2000			807595-E1



LEGEND :

S-1	CATCH BASIN (STORMWATER)
GP-1	GEOPROBE (PROPOSED)
MW-1	GROUNDWATER MONITORING WELL (EXISTING)
SD-114	RIVER SEDIMENT SAMPLES WESTON STUDY
TMW-2	TEMPORARY MONITORING WELL (DECOMMISSIONED)
6	McCALL OIL HISTORICAL RELEASE LOCATIONS
6	GREAT WESTERN CHEMICAL HISTORICAL RELEASE LOCATIONS
	SITE BOUNDARY
22	GROUNDWATER ELEVATION CONTOURS (FEET, MSL) (DASHED WHERE UNCERTAIN, WATER LEVELS FOR FEBRUARY, 1999)

NOTE:
MAP MODIFIED FROM McCALL OIL, EVACUATION PLAN, PORTLAND MARINE TERMINAL, "C-1", 8-26-93, PROJECT 1923 (1923.01\C01B.DWG)

SCALE
0 150 300 FEET

IT CORPORATION
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Portland, Oregon 97224
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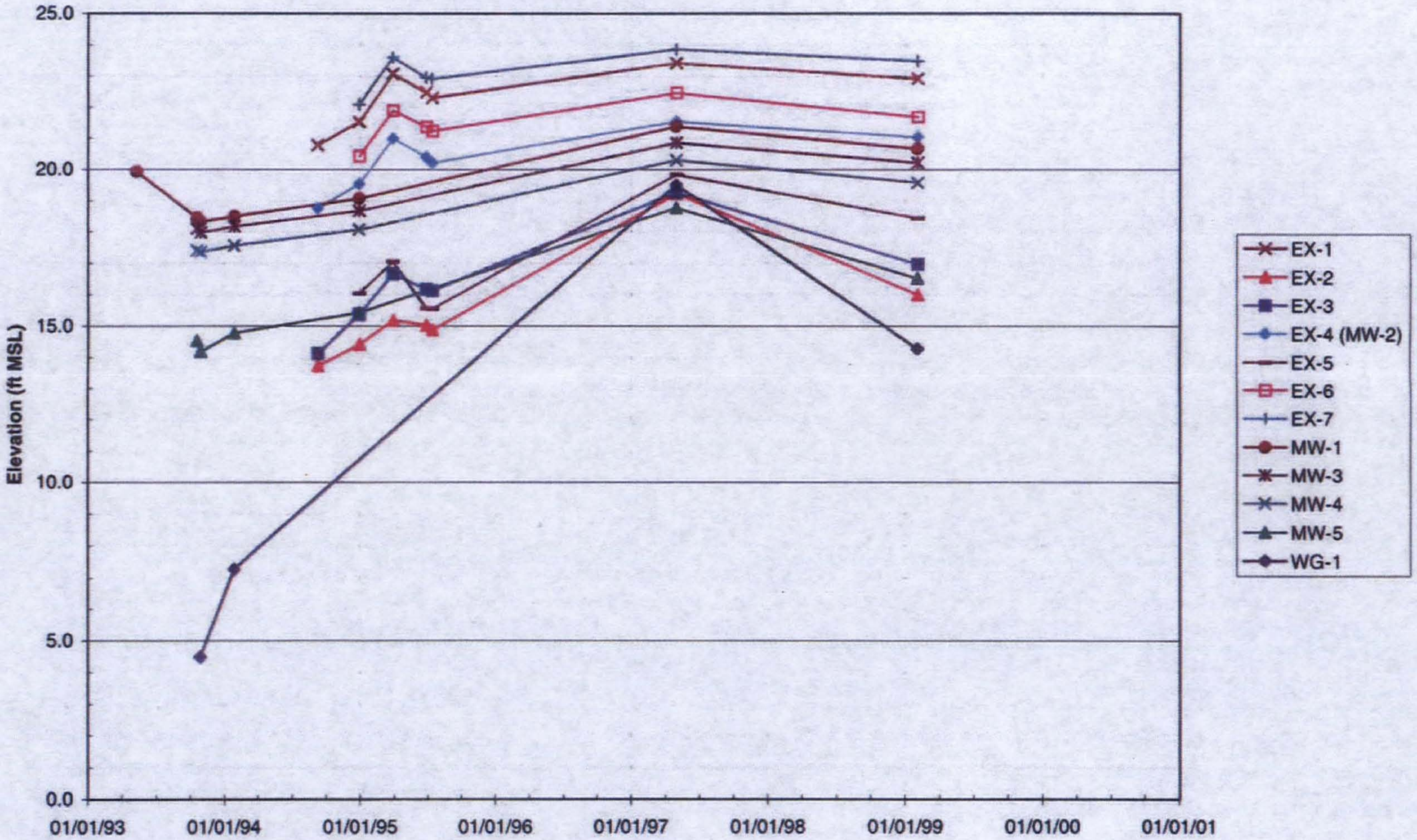
FIGURE 2-4

PROPOSED SAMPLING LOCATIONS FOCUSED RI WORKPLAN

McCALL OIL AND CHEMICAL CORPORATION
PORTLAND, OREGON

Figure 2-5

Monitoring Well and Willamette River Hydrographs
McCall Oil and Chemical Corporation
Focused RI Workplan

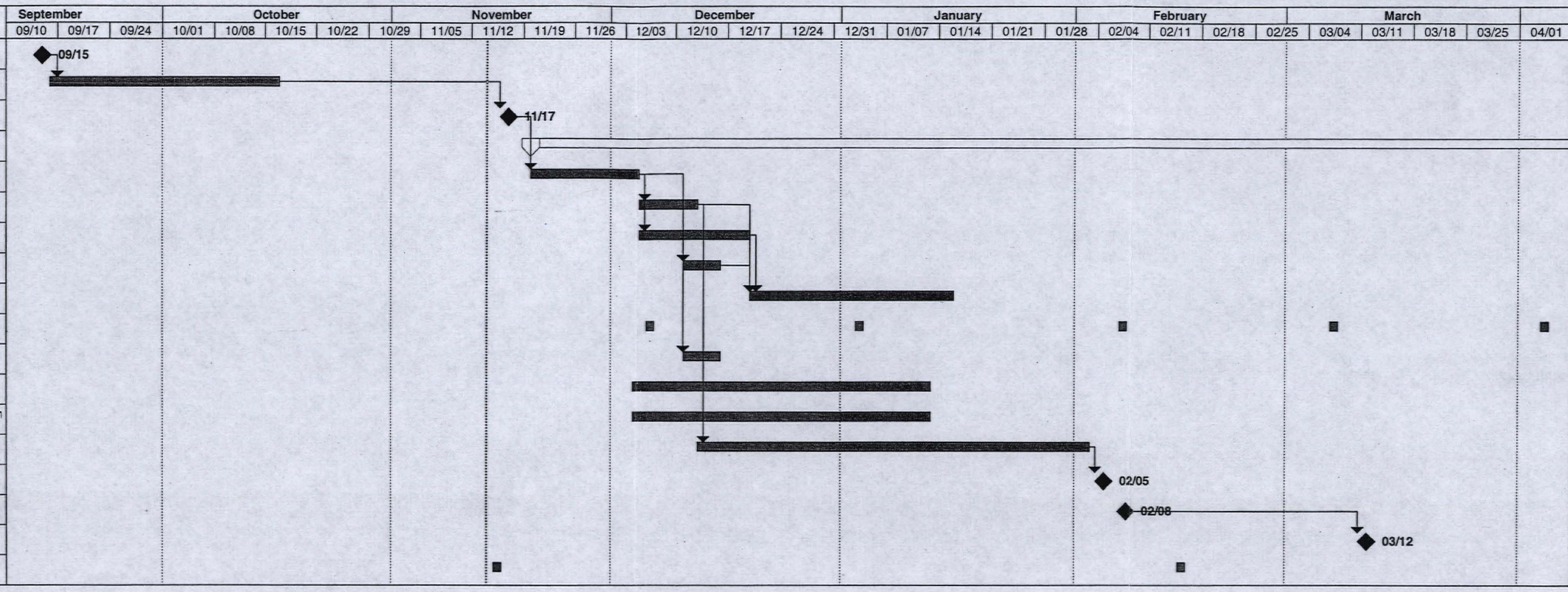


N\Remed\Jobs\mccallGWC\database\Water-base.xls\Hydrographs

11/14/2000

Figure 6-1
Schedule for Focused Remedial Investigation
McCall Oil & Chemical Corporation/Great Western Chemical Company

ID	Task Name
1	Submit Draft Focused RI Workplan
2	DEQ Review and Comment
3	Submit Final Focused RI Workplan
4	**Implement Scope of Work**
5	Coordinate Field Activites
6	Geoprobe Sampling
7	Monitoring Well Sampling
8	Stormwater Sampling
9	Laboratory Analysis
10	**Monthly Water Levels**
23	Aquifer Testing
24	Level 1 Scoping Assessment
25	Gather Water Use/Land Use Information
26	Data Evaluation/Preliminary Screening
27	Submit Interim Status Report
28	Interim Status Meeting with DEQ
29	Submit Draft Risk Assessment Workplan
30	**Quarterly Reporting**



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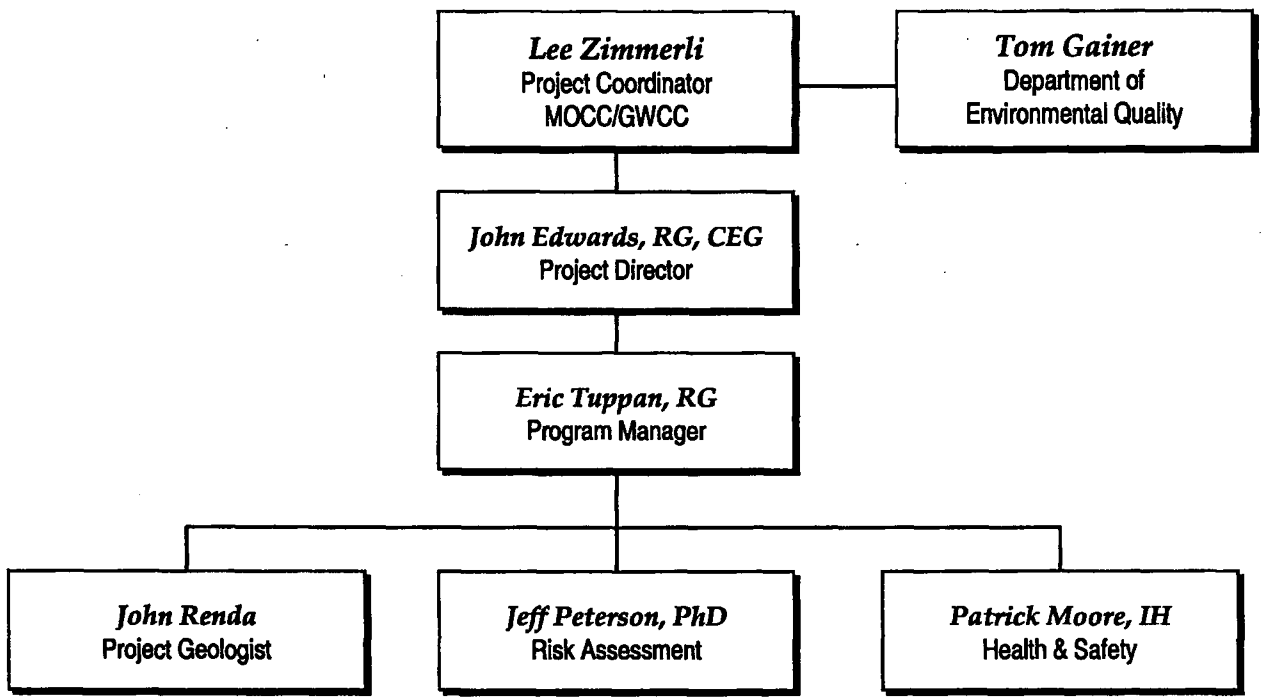
Date: Tue 11/14/00

Task | Progress | Milestone | Summary | Rolled Up Task | Rolled Up Milestone | Rolled Up Progress

Figure 6-2

Project Team Organization
Focused Remedial Investigation

McCall Oil & Chemical Corporation
Great Western Chemical Company



APPENDIX A
SAMPLING AND ANALYSIS PLAN

SAMPLING AND ANALYSIS PLAN
FOCUSED REMEDIAL INVESTIGATION

MCCALL OIL AND CHEMICAL CORPORATION

Prepared for

McCall Oil and Chemical Corporation

November 9, 2000

Prepared by

IT Corporation
15055 SW Sequoia Parkway, Suite 140
Portland, Oregon 97224

Project 812807

CONTENTS

CONTENTS (Continued)

ILLUSTRATIONS

Following Text

Figures

1 INTRODUCTION

On behalf of McCall Oil and Chemical Corporation (MOCC) and Great Western Chemical Company (GWCC), IT Corporation (IT) has developed this sampling and analysis plan (SAP) to guide the collection of soil, sediment, groundwater, and surface water samples at the MOCC/GWCC facility in Portland, Oregon.

The SAP describes the standard field operating procedures for conducting fieldwork at the MOCC/GWCC facility. The SAP includes procedures for a focused remedial investigation (RI) or other field investigative activities at the site. The workplan identifies specific media to be sampled and the locations and types of field or laboratory analyses that will be conducted.

The fieldwork will consist primarily of soil/sediment sampling and testing, groundwater sampling and testing, surface water sampling and testing, and hydrology monitoring.

The goal of sampling is to obtain reliable data concerning hydrogeologic conditions and the chemistry of environmental media, in support of the goals and objectives of the workplan. This SAP is an integral part of the workplan, and describes methods that will be used for sampling environmental media. This SAP is supported by a quality assurance project plan (QAPP) and a site-specific health and safety plan (Appendix C).

Laboratory analytical methods are not included in this SAP. For specific analytical methods, refer to the QAPP and workplan.

2 ACCESS AND SITE PREPARATION

2.1 Site Access

IT personnel will notify the MOCC/GWCC site coordinator before beginning each phase of work at the site, and on arrival will sign a visitors registration log at the facility office. Reasonable efforts will be made to provide facility access to the employees, agents, and contractors of the Oregon Department of Environmental Quality (DEQ). On arrival, agency representatives must sign the visitors log at the facility office and describe their visit. While on site, they will be escorted by MOCC/GWCC personnel. Access to work areas may be temporarily restricted because of safety concerns related to facility operations or field investigations.

2.2 Site Preparation and Coordination

Before field sampling programs begin at the MOCC/GWCC facility, public and private utility-locating services and other information sources (such as facility-specific plans) will be used to check for underground utilities or pipelines near each boring. IT will coordinate fieldwork with the MOCC/GWCC site coordinator, both to define the locations of possible on-site utilities and piping and to avoid interrupting site operations. Before drilling at each location, the upper few feet of soil will be tested with a hand-auger or other probe to test for obstructions or unidentified utilities.

3 SEDIMENT AND STORMWATER SAMPLING

The focus of sediment and stormwater sampling is to evaluate whether site-related chemicals are present at sufficient concentration to adversely affect Willamette River sediment. Sediment samples will be collected from the top one foot of sediment in stormwater catchbasins and at one location on the shore of the Willamette River. Stormwater samples will be collected from the top of the water column in catchbasins and drainage sumps, or at discharge pipes.

Sample locations are shown on the location map (Figure 2-4) in the focused RI workplan.

3.1 Sediment Sampling

3.1.1 Method

Sediment samples will be collected from stormwater catchbasins and from the river shoreline. Sediment samples can be collected from the top of the sediment profile in two ways: (1) if the depth to sediment beneath the water column is shallow (less than 2 feet), the sediment can be removed with a clean shovel; (2) if the depth to sediment is greater than approximately 2 feet, a dredge will be used.

Sediment samples will be collected using the following method:

- A clean sampling dredge (LaMott™ or Wildco-Ekman™ bottom-sampling dredge or equivalent) will be lowered to the top of the sediment to collect the sample. After collecting the sample, the dredge will be retrieved and the contents emptied into a clean stainless steel bowl.
- If samples are cohesive, or in areas of shallow water, a clean shovel will be used to remove sediment from the ditch. Sediment will be transferred directly from the shovel to a clean stainless steel bowl. This process will be repeated until a sufficient sample volume has been retrieved.
- Wearing clean gloves, the technician will transfer the sediment samples from the bowl to laboratory-supplied containers.

- Filled containers will be labeled and packed with ice in shipping containers and delivered under chain-of-custody procedures (see Figures) to the contract laboratory.

3.1.2 Nomenclature

Samples will be labeled with the location, depth, and date of collection. For example, a sediment sample collected at sediment sample location S-2, at a depth of 1 foot below the top of the sediment surface on October 12, 2000, will have the following label: S-02-01-101200. The depth for a sediment sample is considered the bottom of the sediment interval where it was collected.

3.2 Surface Water Sampling

Surface water will be sampled from stormwater catchbasins, a drainage sump, and the oil-water separator discharge pipe to the river.

3.2.1 Method

Surface water samples will be collected as follows:

- A laboratory-supplied sample container will be immersed below the water surface, with the opening facing upstream. If preservatives have been placed in the container, it will be tilted up to minimize the possibility of losing the preservative.
- Samples will be collected from the end of the discharge pipe by placing the sample container in the center of flow until filled.
- Filled containers will be labeled and packed with ice in shipping containers and delivered under chain-of-custody protocol (see Figures) to the contract laboratory.

3.2.2 Nomenclature

Samples will be labeled with the location and date of collection. For example, a surface water sample collected at sample location S-3 on October 12, 2000, will have the following label: S-03-101200.

4 DRILLING AND SAMPLING

This section describes the techniques for drilling test borings, sampling groundwater, and collecting soils for physical testing parameters or chemical analyses. Tasks related to drilling (reconnaissance groundwater sampling during drilling, borehole logging, and soil classification) are also described. The methods outlined in this section conform to requirements for the construction of monitoring wells specified in Oregon Water Resources Department (WRD) administrative rules Chapter 690, division 240, the DEQ's August 1992 guidelines for well installation, and IT's corporate guidelines for conducting such work.

4.1 Drilling Test Borings

The borings will be advanced by a truck-mounted Geoprobe™ rig. Decontamination of drilling and sampling equipment will be performed as described Section 6.

Continuous soil samples will be obtained by closed-piston sampling. Coring will start at the ground surface with a 48-inch-long, 1.5-inch inside-diameter (ID) core sampler. The piston tip will be loosened and the sampler will be advanced into the ground, thereby coring the soil inside the sampler's disposable, single-use plastic liner. The sampler will then be withdrawn to retrieve the liner and the soil sample. The liner will be cut to remove the soil sample.

A new liner will be placed inside the core sampler, and the core sampler with the piston tip locked will be advanced to the top of the next sample interval. The piston tip will then be released and the core sampler advanced another 48 inches to obtain the next sample. This process will be repeated until refusal is met or sufficient water is encountered. Groundwater ranges from 13 to 20 feet below ground surface. Depth to groundwater will be estimated from monitoring wells before mobilizing to the field. Between samples, the core sampler, including the piston tip and attached rod, will be decontaminated, stored, and handled consistent with procedure specified in the SAP.

The core sample will be examined to develop lithologic data. The samples will be described in the field as to their color, structure, texture, mineral composition, moisture, and percent recovery, according to ASTM Method D 2488-84. Samples will also be examined for visual chemical impacts or odors and the observations noted. These procedures will be applied to all soil sampled in each borehole.

Groundwater Sampling. One groundwater sample will be obtained from each temporary direct-push borehole using a 4-foot-long, stainless steel, wire-wrapped screenpoint sampler attached to the drive rods used to advance the soil-core sampler.

After advancing the screenpoint sampler to the desired depth, the screen will be opened by pulling back the rod. Before measuring the depth to water with a decontaminated water level probe, samplers should insert a decontaminated small-diameter metal rod to open the screen and make sure it is at the desired depth.

A vacuum pump mounted on the Geoprobe rig and new, polyethylene intake tubing equipped with a new, disposable stainless-steel check valve will be used to draw water through the screen and to the ground surface, where it will be discharged to a decontaminated vacuum flask. Field water-quality parameters (pH, specific conductance, and temperature) will then be measured by pouring the water from the flask into a decontaminated openmouth container. Portable, calibrated meters will be used to measure the field water-quality parameters.

The volatile organic compound (VOC) samples will be obtained first, by disconnecting the polyethylene tubing from the vacuum flask, removing it from the push rods, emptying the tubing completely of water, and reinserting the tubing into the screenpoint sampler. The tubing will then be gently raised and lowered, to draw water inside the tubing. The tubing will be withdrawn from the rods and water inside the tubing will be transferred directly and carefully to laboratory-supplied glass vials.

Samples to be tested for non-VOC constituents will be obtained by reinserting the tubing and using the vacuum pump to draw water through the tubing into the vacuum flask. Water in the flask will then be transferred directly to laboratory-supplied containers. Because the metals samples from the direct-push borings are expected to be turbid, water in the flask will be then be filtered in the field with a new, disposable 0.45-micron filter (or other approved filter size) before it is placed in sample containers. Groundwater filtration can be accomplished with a reusable, stand-alone filtration apparatus and peristaltic pump. Any equipment that contacts the sample and is intended to be reused must be properly decontaminated between samples.

Soil Sampling. Samples of visually-impacted soil will be collected, placed in laboratory-supplied containers, and stored in an iced-cooler until transfer to the laboratory for analysis. Because of likely heterogeneity of soil composition, no duplicate soil samples will be collected or analyzed.

Nomenclature. Soil samples will be labeled similar to sediment samples. A soil sample collected from a test boring at a depth of 3.5 feet (i.e., the bottom of the sampler is at 3.5 feet) will have the following number: GP-04-S-3.5. Reconnaissance groundwater samples will be labeled similarly to the soil samples, except the matrix designation will be GW. A groundwater sample collected from test boring GP-04 at a depth of 12 feet bgs will have the following sample number: GP-04-GW-12.

The sample depth for groundwater samples is specified as the middle of the drive point interval.

4.2 Borehole Decommissioning

Test borings will be decommissioned consistent with OAR 690-240. At the end of drilling, the boreholes will be abandoned by filling the borehole with bentonite chips. When the top of the bentonite chips has been brought above the static water level, 5 gallons of potable water will be added for every 5 feet of bentonite chips. The volume of the borehole and the amount of bentonite chips added will be recorded on the exploratory boring log (see Figures).

4.3 Temporary Piezometer Installation

Selected borings will be converted to temporary piezometers, as described in this section. The piezometers will be constructed of 0.5-inch ID (1.5-inch outside diameter) polyvinyl chloride (PVC) flush-threaded riser casing attached to 3-foot-long sections of flush-threaded prepacked well screen. Screen length may vary but is not expected to exceed 9 feet. The screens will be placed at the equivalent interval as the nearby monitoring well.

The screen and casing will be inserted into the cased borehole, using the push rods as temporary casing. Approximately 1 to 2 feet of silica sand will be placed through the push rods to create a platform at the top of the screen. The remainder of the borehole will be backfilled with dry bentonite granules. The wells will be completed with locked watertight caps inside flush-mounted protective covers.

The piezometers will be developed to improve their hydraulic connection with groundwater to obtain representative water levels. The wells will be developed before water levels are measured to determine the hydraulic gradient. Consistent with Oregon Water Resources Department rules, the wells will not be developed for at least 12 hours after completion if the well seal was constructed of dry bentonite or for at least 24 hours after completion if the well seal was constructed of bentonite grout.

The piezometers will be developed by appropriate combinations of surging, bailing, or pumping with a peristaltic pump, an inertial pump, an electrical submersible pump, or a vacuum flask.

Development will continue until turbidity clears, or until the pH, temperature, and specific conductance of the purged water stabilize to within 5 percent of the previous measurement. These parameters will be measured before development and after removal of each casing volume. Groundwater produced during development will be managed consistent with waste management procedures, Section 7.

4.4 Borehole Logging and Soil Classification

A log of soil samples from each boring will be prepared in the field by a geologist registered in Oregon, or by a geologist working under the supervision of a registered Oregon geologist. Boring logs will include the project name and location, name of the drilling contractor, drilling method, sampling method, soil and groundwater sample depths, blow counts, and description of soils encountered. Soil samples will be described using ASTM designation D2488-84, "Standard Practice for Description and Identification of Soils (Visual-Manual Procedures)." The standard involves describing color, grain size, moisture content, density, organic matter, and other observed characteristics. The information will be recorded on a standard IT exploratory boring log (See Figures).

4.5 Physical Testing Program

One sample of the aquifer material will be collected from approximately 50 percent of the borehole locations and will be analyzed for total organic carbon by ASTM D4129-82M and for grain size distribution by ASTM D422.

4.6 Laboratory Chemical Analysis

Soil samples will be analyzed for the parameters specified in the workplan.

5 GROUNDWATER MONITORING AND SAMPLING

5.1 Water Level Monitoring

Depth-to-water (groundwater elevation) will be measured in existing monitoring wells using the procedures in this section. The data will be used to estimate the horizontal groundwater flow direction and gradient at the site.

Measurements will be taken with an electronic water-level indicator. Levels will be measured to the nearest 0.01 foot from a surveyed notch or mark at the top of the PVC casing or other reference point. IT will convert the measurements to an elevation relative to the surveyed datum. Measurements will be recorded immediately on field sheets with the date, time (on a 24-hour clock), reference point, and initials of the person who made the measurements. Water-level measurements taken for a single data set will be obtained for as short a period as practical, to reduce the potential for external factors (e.g., rainfall, barometric pressure, and river tidal changes) to affect water levels nonuniformly within the study area. The water-level indicator will be decontaminated as specified in Section 6.

5.2 Groundwater Sample Collection

Groundwater sampling methods to be used at the MOCC/GWCC facility are designed to obtain samples as representative of in situ groundwater quality as possible. Samples will be collected according to the schedule provided in the workplan.

5.2.1 Procedure

Sample collection and handling will be consistent with procedures described below and in Section 4 of the QAPP. The monitoring wells will be sampled as follows:

- The depth to water will be measured with an electric water-level indicator. The results will be noted on the field sampling data sheet (See Figures).

- Before a well is sampled, at least three casing volumes will be purged with a high-capacity peristaltic pump fitted with silicon and Tygon tubing, or with a Teflon or disposable bailer secured with monofilament line.

- After each well casing volume is removed, temperature, pH, and specific conductance will be measured with portable meters calibrated according to manufacturer's directions. The data will be immediately recorded on the field sampling data sheet. Specific conductance and pH must stabilize to within 10 percent of the previous reading before a sample is collected. A minimum of three parameters measurements will be recorded.

- If any well purges dry during pore volume removal, the well will be allowed to recover for no more than 24 hours before a sample is collected. At least one pore volume must be removed from each well before a sample is collected.

- Groundwater samples will be collected directly from the peristaltic pump discharge line or with a Teflon or disposable bailer, as appropriate. Samples will be transferred from the sampling equipment to a container specifically prepared for certain parameters. Samples for VOC analysis will be collected first, in a bailer. A bottom-drain-control valve will be used to transfer VOC samples from the bailer to the appropriate sample container. The sample will be poured down the sides of the sample bottle, not splashed into its base. Samples collected for VOC analysis will have no headspace, to minimize the loss of VOCs by volatilization.

- Samples collected for dissolved metals analysis will be filtered during collection, using disposable QED Sample Pro™ or similar 0.45-micron, in-line filters. The filters will be attached directly to the peristaltic pump discharge line. Each in-line filter will be used only once. Samples collected for laboratory testing of field parameters, VOCs, base-neutral-acid extractable, and polynuclear aromatic hydrocarbons (PAHs) will not be filtered.

- Disposable bailers will be used for only one well and will then be properly disposed of. Other equipment used for water sample collection will be decontaminated both before its use at the facility and after each sample is collected (see Section 6).

- Field activities and sampling data (well purging data, type of container used for each sample, and preserved used) will be recorded on the field sampling data sheet. Any deviations from the general procedures will be noted on field records and will be brought to the attention of the project manager.

- Samples will be labeled, preserved, and shipped to the analytical laboratory.

- Quality control samples will include at least one duplicate sample for every 10 samples, one equipment blank for every 10 samples, and one transport blank (VOCs only) for every set of samples transported to the laboratory.

5.2.2 Nomenclature

Groundwater samples from facility monitoring wells will be blind-labeled (an additional laboratory quality control procedure). Each blind-labeled sample will be designated by the abbreviation "GWC-," followed by the date of collection, then by "-" and a unique identification number. Numbers will be assigned in sequence, starting with 1, during a single monitoring period, regardless of the collection date. For example, a sample labeled GWC-101200-7 would indicate that it was obtained at the MOCC site on October 11, 2000, and that it was the seventh sample obtained for that sampling event.

Reconnaissance test boring groundwater samples will not be blind-labeled, because they are not reproducible. Instead, test-boring groundwater samples will be labeled to clearly identify the source of the sample.

5.3 Laboratory Analysis

Groundwater samples and associated quality control samples will be analyzed for the parameters specified in the workplan.

6 EQUIPMENT CLEANING AND DECONTAMINATION PROCEDURES

Decontamination procedures are specified for the various types of fieldwork conducted. The objective for decontamination is to reduce the chance of cross-contaminating samples.

6.1 Drilling, Soil Sampling, Groundwater Sampling

6.1.1 Drilling Equipment

The working area of the drill rig and all downhole drilling equipment will be steam-cleaned or hot-water pressure-washed both after arrival on site and after use in each borehole or monitoring well. The drilling equipment will be thoroughly cleaned before it leaves the site at the end of drilling. The drilling rig and equipment will be cleaned in a designated area of the MOCC/GWCC facility.

6.1.2 Soil Sampling Equipment

All sampling equipment and reusable materials that contact the soil will be decontaminated on site and between sampling locations. Decontamination will follow this sequence:

- Tap-water rinse (may consist of high-pressure, hot-water rinse)
- Nonphosphatic detergent wash, consisting of a dilute mixture of Liquinox and tap water (visible soil to be removed by scrubbing)
- Tap-water rinse
- Distilled-water rinse
- Methanol solution rinse (1:1 solution with distilled water)
- Final distilled-water rinse

6.1.3 Groundwater Sampling Equipment

Groundwater sampling equipment includes items used during reconnaissance groundwater sampling (see Section 4.1) and routine sampling in monitoring wells. All equipment that contacts sampled groundwater will be decontaminated before its first use and between sampling locations. Decontamination will proceed as follows:

- Distilled-water rinse
- Nonphosphatic detergent (e.g., Liquinox) and water wash
- Distilled-water rinse
- Dilute methanol solution rinse (1:1 solution with distilled water)
- Final distilled-water rinse

Water generated by decontamination will be properly handled, according to procedures specified in Section 7.

6.2 Water Level Measurements

Before the electric meter used to measure water levels is used at the site, the entire reel of water-level line will be decontaminated. The portion of the water-level detector that enters the water (the tip) and a 5-foot section above it will also be decontaminated after its use in each well. Decontamination will be in the following sequence:

- Nonphosphatic detergent wash
- Distilled-water rinse

7 WASTE MANAGEMENT

Residual soils, groundwater, and decontamination fluids (commonly referred to as investigation-derived waste [IDW]) will be handled as specified in this section. Generally, material generated during this scope of work will be contained, identified, and characterized. Holding containers (tops and sides) will be labeled with their contents, the date of collection, and the origin of the material. The drums will be sealed, secured, and transferred to a designated area on the site at the end of each workday. The IDW will be stored in the designated holding area until it has been characterized.

After the work is complete and analytical results are received, residual soils and liquids will be evaluated for disposal method. MOCC/GWCC will be responsible for disposing of the IDW (including characterization), consistent with DEQ regulations.

7.1 Soil Cuttings

Soil cuttings originating from drilling will be contained in 55-gallon drums, which will be stored in the designated area. If warranted, a composite sample from the drum will be analyzed to assess disposal options. Each drum will be labeled to include the source of the soil.

7.2 Groundwater

Well purge water generated during development and sampling will be contained in 55-gallon drums in a designated area on site, pending analytical results. Each drum will be properly secured and labeled. The label will include the source of the water.

7.3 Decontamination Water

Water generated by equipment decontamination will be properly contained during decontamination activities. Decontamination water will be transferred to 55-gallon drums with sealable lids. Each drum will be labeled to indicate where the decontaminated equipment was used.

8 HYDRAULIC CONDUCTIVITY TESTING

8.1 Slug Tests

Horizontal hydraulic conductivities within the shallow and deep aquifers will be evaluated by performing rising- and falling-head slug tests in wells EX-5, EX-6, EX-7, and MW-4. A bailer (PVC or disposable) or solid stock of PVC will be used to remove or displace a slug of water from the well. An electric water-level indicator or an electronic pressure transducer and datalogging system will be used to monitor the rise or fall in water level. Measurements will be analyzed using methods described in Bouwer and Rice (1976), or by another appropriate analytical technique.

REFERENCE

Bouwer, H., and R. C. Rice. 1976. A slug test for determining the hydraulic conductivity of unconfined aquifers with completely or partially penetrating wells. Water Resources Research 12(3):423-428.

Columbia Analytical Services INC.
An Employee-Owned Company

CHAIN OF CUSTODY

SR#: ____________

1317 South 13th Ave. • Kelso, WA 98626 • (360) 577-7222 • (800) 695-7222 • FAX (360) 636-1068

PAGE ______ OF ______ COC #____________

PROJECT NAME

PROJECT NUMBER

PROJECT MANAGER

COMPANY/ADDRESS

PHONE # | FAX #

SAMPLER'S SIGNATURE

SAMPLE I.D.	DATE	TIME	LAB I.D.	MATRIX	NUMBER OF CONTAINERS	Semivolatile Organics by GC/MS 625☐ 8270☐	Volatile Organics 624☐ 8260☐ 8021☐ BTEX☐	Pesticide / Herbicides 608☐ 8081☐ 8141☐ 8151☐	Total Toxic Organics (TTO) 608☐ 624☐ 625☐	PCB AROCLORs 8082	NWTPH - HCID☐ NWTPH-D☐ NWTPH-G☐	Hydrocarbon Scan☐ O & G☐	Chlorophenolics - 8151M Tri☐ Tetra☐ PCP☐	PAHs 8310☐ SIM☐	GC/MS-SIM PAH☐ Phenol☐ Phthalates☐	Metals, Total or Dissolved (See list below)	Cyanide☐ Hex-Chrom☐	pH, Cond, Cl, SO_4, PO_4, F, NO_2, NO_3, BOD, TSS, TDS (circle)	NH_3-N, COD, Total-P, TKN, TOC, DOC (circle)	TOC 9020☐	AOX 1650☐ 506☐			REMARKS

REPORT REQUIREMENTS

___ I. Routine Report: Method Blank, Surrogate, as required

___ II. Report Dup., MS, MSD as required

___ III. Data Validation Report (includes all raw data)

___ IV. CLP Deliverable Report

___ V. EDD

INVOICE INFORMATION

P.O. # ____________

Bill To: ____________

TURNAROUND REQUIREMENTS

____ 24 hr. ____ 48 hr.

____ 5 Day

____ Standard (10-15 working days)

____ Provide FAX Results

____

Requested Report Date

Circle which metals are to be analyzed:

Total Metals: Al As Sb Ba Be B Ca Cd Co Cr Cu Fe Pb Mg Mn Mo Ni K Ag Na Se Sr Tl Sn V Zn Hg

Dissolved Metals: Al As Sb Ba Be B Ca Cd Co Cr Cu Fe Pb Mg Mn Mo Ni K Ag Na Se Sr Tl Sn V Zn Hg

SPECIAL INSTRUCTIONS/COMMENTS:

RELINQUISHED BY:	RECEIVED BY:	RELINQUISHED BY:	RECEIVED BY:
Signature / Date/Time	Signature / Date/Time	Signature / Date/Time	Signature / Date/Time
Printed Name / Firm	Printed Name / Firm	Printed Name / Firm	Printed Name / Firm

FIELD SAMPLING DATA SHEET

the group
15055 SW Sequoia Parkway, Suite 140
Portland, Oregon 97224-7712
Office: (503) 624-7200 Fax: (503) 620-7658

PROJECT NAME: McCall Oil and Chemical Corporation **WELL ID:**

SITE ADDRESS: Portland, OR **BLIND ID:**

DUP ID: NA

WIND FROM:	N	NE	E	SE	S	SW	W	NW	LIGHT	MEDIUM	HEAVY
WEATHER:	SUNNY		CLOUDY		RAIN		?		**TEMPERATURE:**	°F . °C	

[Circle appropriate units]

HYDROLOGY/LEVEL MEASUREMENTS (Nearest 0.01 ft)

Date	Time	DT-Bottom	DT-Product	DT-Water	DTP-DTW [Product Thickness]	DTB-DTW [Water Column]		Volume (gal) [Water Column x Gal/ft]
/ /	:	.	.	.	.	.	X 1	.
/ /	:	.	.	.	.		X 3	.

Gal/ft = $(dia./2)^2 \times 0.163$	1" =	0.041	2" =	0.163	3" =	0.367	4" =	0.653	6" =	1.469	10" =	4.080	12" = 5.875

§ METHODS: (A) Submersible Pump (B) Peristaltic Pump (C) Disposable Bailer (D) PVC/Teflon Bailer (E) Dedicated Bailer (F) Dedicated Pump (G) Other =

GROUNDWATER SAMPLING DATA (if product is detected, do NOT sample) Sample Depth:

Bottle Type	Date	Time	Method §	Amount & Volume mL		Preservative [circle]	Ice	Filter	pH	√ [If used]
VOA Glass	/ /	:		3	40 ml	HCl	YES	NO		
Amber Glass	/ /	:			250, 500, 1L	(None) (HCl) (H_2SO_4)	YES	NO		
White Poly	/ /	:			250, 500, 1L	None	YES	NO	NA	
Yellow Poly	/ /	:			250, 500, 1L	H_2SO_4	YES	NO		
Green Poly	/ /	:			250, 500, 1L	NaOH	YES	NO		
Red Total Poly	/ /	:			250, 500, 1L	HNO_3	YES	NO		
Red Diss. Poly	/ /	:			250, 500, 1L	HNO_3	YES	YES		
	/ /	:			250, 500, 1L		YES			
		Total Bottles (include duplicate count):								

Analysis Allowed per Bottle Type

BOTTLE TYPE	TYPICAL ANALYSIS ALLOWED PER BOTTLE TYPE (Circle applicable or write non-standard analysis below)
VOA - Glass	(8010) (8010/8020) (8020) (8240) (8260) (BTEX) (TPH-G) (BTEX/TPH-G) OR[ ] WA[ ]
AMBER - Glass	(PAH) (TPH-HCID) (TPH-D) (TPH-418.1) (Oil &Grease) OR[ ] WA[ ]
WHITE - Poly	(pH) (Conductivity) (TDS) (TSS) (BOD) (Turbidity) (Alkalinity) (HCO_3/CO_3) (Cl) (SO_4) (NO_3) (NO_2) (F)
YELLOW - Poly	(COD) (TOC) (Total PO_4) (Total Kekdahl Nitrogen) (NH_3) (NO_3/NO_2)
GREEN - Poly	(Cyanide)
RED TOTAL - Poly	(As) (Sb) (Ba) (Be) (Ca) (Cd) (Co) (Cr) (Cu) (Fe) (Pb) (Mg) (Mn) (Ni) (Ag) (Se) (Tl) (V) (Zn) (Hg) (K) (Na)
RED DISSOLVED - Poly	(As) (Sb) (Ba) (Be) (Ca) (Cd) (Co) (Cr) (Cu) (Fe) (Pb) (Mg) (Mn) (Ni) (Ag) (Se) (Tl) (V) (Zn) (Hg) (K) (Na) (Hardness) (Silica)

WATER QUALITY DATA Purge Start Time: : Pump/Bailer Inlet Depth:

Meas. [Casing]	Method § [Select A-G]	Purged (gal) [Cumulative Totals]	pH	E Cond (µS)	Temp °C	Other	Diss O_2 (mg/l)	Water Quality [Clarity, Color]
4		.	.		.		.	
3		.	.		.		.	
2		.	.		.		.	
1		.	.		.		.	
0		0.00	:		.		.	

SAMPLER: ______________________ ______________________
(PRINTED NAME) (SIGNATURE)

the group

Soil/Sediment Field Sampling Data

Location/Address ______________________ Boring Number ______________________

Boring Location ______________________ Sampler ______________________

Project Name __________ # __________ Date, Time ______________________

Client/Contact ______________________ Weather ______________________

Sample Number	Depth Interval Top/Bottom (ft)	Sample Type	Sampling Method	Comments Bottle Size & Number

the group

LOG OF EXPLORATORY BORING

CLIENT/PROJECT NAME ____________________

____________________ PROJECT # ____________________

GEOLOGIST/ENGINEER ____________________

DRILLING CONTRACTOR ____________________

DRILLING METHOD ____________________

____________________ HOLE DIA. ____________________

BORING NO. ____________________

DATE BEGAN ____________________

DATE COMPLETED ____________________

TOTAL DEPTH ____________________

SHEET ________ OF ________

OTHER* ______	WELL OR PIEZOMETER DETAILS	SAMPLING DATA				DEPTH IN FEET	SOIL GROUP SYMBOL (USCS)	WATER LEVEL DATA				
		SAMPLING METHOD	SAMPLE NUMBER	BLOWS/FT	DEPTH SAMPLED			DEPTH				
								TIME				
								DATE				
								BORING DEPTH				

FIELD LOCATION OF BORING:

GROUND ELEVATION ________

DATUM ________

LITHOLOGIC DESCRIPTION

REMARKS:

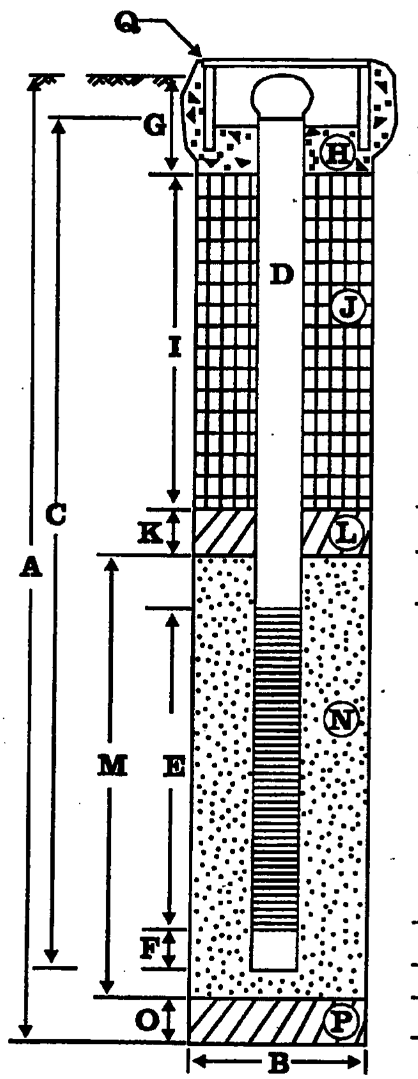
*NOTE: Specify data recorded in undesignated column (e.g. conductance, pH, tip reading, pocket torvane, etc.)

the group

WELL DETAILS

Project Number:	____________	Boring/Well No.:	____________
Client Name:	____________	Top of Casing Elev.:	____________
Project Name:	____________	Ground Surface Elev.:	____________
Location:	____________	Installation Date:	____________
Driller:	____________	Permit/Start Card No.:	____________

Depth (ft, bgs) | Elev. (ft, msl)



EXPLORATORY BORING

A. Total depth: ________ft.

B. Diameter ________in.

Drilling method: ________

WELL CONSTRUCTION

C. Well casing length: ________ft.

Well casing material: ________

D. Well casing diameter: ________in.

E. Well screen length: ________ft.

Well screen type: ________

Well screen slot size: ________in.

F. Well sump/end cap length: ________ft.

G. Surface seal thickness: ________ft.

H. Surface seal material: ________

I. Annular seal thickness: ________ft.

J. Annular seal material: ________

K. Filter pack seal thickness: ________ft.

L. Filter pack seal material: ________

M. Sand pack thickness: ________ft.

N. Sand pack material: ________

O. Bottom material thickness: ________ft.

P. Bottom material: ________

Q. Vault box type: ________

Well centralizer depths: ________ft.

NOTES:

Installed by: ____________

Reviewed by: ____________

Date: ____________

P\N:\Data\Projects\Geology\Forms\Welldetails-flush.DOC\JR

APPENDIX B
QUALITY ASSURANCE PROJECT PLAN

QUALITY ASSURANCE PROJECT PLAN
FOCUSED REMEDIAL INVESTIGATION

MCCALL OIL AND CHEMICAL CORPORATION
PORTLAND, OREGON

Prepared for

McCall Oil and Chemical Corporation

November 13, 2000

Prepared by

IT Corporation
15055 SW Sequoia Parkway, Suite 140
Portland, Oregon 97224

Project # 812807

Quality Assurance Project Plan
McCall Oil and Chemical Corporation
Portland, Oregon

The material and data in this report were prepared under the supervision and direction of the undersigned.

IT Corporation

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1 INTRODUCTION

This quality assurance project plan (QAPP) includes information for characterization activities at the McCall Oil and Chemical Corporation (MOCC) and Great Western Chemical Company (GWCC) site in Portland, Oregon (ESCI ID #134). Work implemented under the workplan and sampling and analysis plan (SAP) will be consistent with this version of the QAPP.

The purpose of the QAPP is to describe the procedures that will be used during the investigation process to satisfy the following items:

- Data collected are high-quality, representative, and verifiable.
- Use of resources is cost-effective.
- Data are usable by MOCC/GWCC and the regulatory agency, to support objectives stated in the voluntary cleanup agreement and the focused RI workplan.

The document includes quality assurance (QA) procedures for field activities, sampling quality assurance/quality control (QA/QC) procedures, and data validation and data entry QA/QC for laboratory data. Functionally, the QAPP provides a consistent set of QA/QC procedures that will be used throughout the work phases identified in the RI workplan. The QAPP supports other documents (e.g., workplan or SAP) by forming the basis for data acquisition and analysis. Through workplans or other documents, the scopes of work for the various activities will reference relevant parts of the QAPP for specifics. For instance, the RI workplan will specify sampling groundwater at a specific monitoring point, and analyzing for a chemical, or suite of chemicals, by a certain analytical method. By referring to the QAPP, the reviewer will be able to determine which constituent(s) are analyzed by the analytical method specified in the workplan, the quantitation limit goals, and the objectives for measurements. He or she will also be able to check for other related information, such as the type of bottle used for sample collection, preservative, etc. Routine tasks such as data validation and reporting are also described in the QAPP.

2 PROJECT ORGANIZATION AND RESPONSIBILITIES

The IT project manager will be responsible for seeing that the procedures and guidelines described in the QAPP are followed. Project related communication between MOCC/GWCC and IT will be through the MOCC/GWCC project director or his designated staff. Communications from IT to third parties will be made only with the knowledge and consent of the project coordinators. MOCC/GWCC and IT will regularly review project status.

3 QA OBJECTIVES FOR MEASUREMENT

The overall QA objective is to collect an acceptable amount of data of known and usable quality. This objective will be achieved and documented using the procedures and criteria set forth in the QAPP. For each measurement made to obtain quantitative data, a set of quality objectives will be used to aid in collecting usable data.

Typically, quality objectives are categorized under precision, accuracy, representativeness, completeness, and comparability (PARCC) parameters. Routine analytical procedures to be used for measuring precision and accuracy include use of replicate analyses, standard reference materials (SRMs), surrogate spikes, matrix spikes, and method blanks. Surrogate spikes, matrix spikes, replicate matrix spikes, and method blanks will be analyzed by the selected laboratory at the minimum frequencies specified below. Additional spikes and replicate analyses may be performed. For the purposes of laboratory analysis, a sample "batch" is considered to be 20 or fewer samples of a single matrix that are extracted or prepared together or are received in the same shipment.

- Surrogate spikes: every sample analyzed for organic compounds will be spiked with selected nontarget analytes and analyzed to evaluate laboratory performance on individual samples.

- Matrix spikes and matrix spike duplicates: one of every 20 samples will be spiked with selected target analytes and analyzed. Matrix spikes will be analyzed for inorganic analytes, and both matrix spikes and matrix spike duplicates will be analyzed for organic analytes. If fewer than 20 samples are analyzed, at least 1 sample per phase will be spiked.

- Method blank: a method blank will be analyzed at a frequency of 5 percent of the total number of samples (i.e., 1 of every 20 samples), 1 per batch of samples, or 1 per day, whichever is greater.

PARCC parameters can be applied to both field measurements and laboratory analytical measurements. Measured media can include soil, water, air, or other media. The precision, accuracy, and completeness criteria to be used for analytical data are summarized in Table B-1. Method reporting limit (MRL) goals are listed in Table B-2.

PARCC parameters used for field measurements are not generally well defined in the guidelines and literature. These parameters have been defined using the best available guidelines to establish field measurement QA objectives, and will be followed as closely as possible.

3.1 Precision

Precision is the degree of agreement between replicate measurements of the same source or sample. Replicate measurements can be made on the same sample or on two samples from the same source. Precision is generally assessed by duplicate measurements of a subset of samples (laboratory or field duplicate samples). The chemical analysis methods define the proportion of the samples being analyzed for which precision must be assessed. This proportion is defined in the laboratory quality assurance manual (QAM). The precision of physical measurements, such as water level measurements, and of field measurements, such as pH and specific conductance, will be based on the general body of data for the instruments and methods, but will not be calculated specifically.

When detected concentrations in either a sample or a duplicate are less than five times the MRL or method detection limit (MDL), data quality objectives for precision suggest that sample and duplicate results should be within plus or minus the MRL of each other. When detected concentrations in the sample and duplicate are both greater than five times the MRL, data quality objectives for precision suggest that the relative percent differences (RPD) between the results should be less than or equal to 20 percent.

The RPD can be calculated as follows:

$$RPD = \frac{(c_1 - c_2) \times 100}{c}$$

where

c_1 = concentration for replicate 1.

c_2 = concentration for replicate 2.

c = mean concentration.

Acceptable precision limits are based on historical databases, as defined by the USEPA. Laboratory duplicate measurements will be obtained for each set of samples submitted, and will be tested for inorganic analytes only. Field duplicates will be evaluated similarly.

3.2 Accuracy

Accuracy measures the level of bias exhibited by an analytical method or measurement. To measure accuracy, a substance with a known value is analyzed or measured, and the result is compared with the known value.

The accuracy of laboratory analysis is assessed by measuring standard reference materials (instrument calibration) and spiked samples (surrogate recoveries and matrix spikes). Standard reference materials are used to calibrate laboratory instruments. The analytical method specifies the frequency and accuracy required for a spiked sample analysis.

Spike recovery is determined by splitting a sample into two portions, spiking one portion with a known quantity of a constituent of interest, and analyzing both portions. Spike recovery is expressed as percent recovery:

$$\text{Percent recovery} = \frac{\Delta c \times 100}{\Delta c_s}$$

where

Δc = measured concentration increase.

Δc_s = known concentration increase.

Acceptable matrix spike recovery limits are based on historical data sets, as defined by the USEPA. Acceptable surrogate recoveries for organic analyses are based on limits calculated by the laboratory, as described in the analytical method.

The accuracy of field measurements is inherent in the instrument and procedure used. Instrumentation and procedures are described in the laboratory's QAM and will meet or exceed current industry standards.

3.3 Representativeness

Representativeness is the degree to which data accurately and precisely represent a characteristic of the population, the natural variation at a sampling point, or an environmental condition. There is no standard method or formula to evaluate representativeness. Specific SAPs are designed to allow collection of representative samples. Representativeness is achieved by selecting sampling locations that are appropriate for the objective of the specific sampling task, and by collecting an adequate number of samples. The representativeness of the data will be evaluated and used to identify data gaps that can be addressed during or following completion of the specific investigation.

3.4 Completeness

Completeness is commonly expressed as a percentage of measurements that are valid and usable relative to the total number of related measurements. Completeness criteria between 80 to 85 percent are identified in the guidance (USEPA, 1987) and will be used to determine the adequacy of the results. The percent completeness is defined as the number of samples analyzed that meet the data quality goals, divided by the total number of samples analyzed and multiplied by 100.

4 SAMPLING PROCEDURES

This section describes how samples will be documented, handled, preserved, and shipped, and also discusses equipment decontamination. Any alterations to the sampling procedures described below will be described on the soil and water field sampling data sheets (FSDSs) and in field sampling memoranda written to the project file.

For each phase of work, specific information as to how many samples will be collected and measured, the frequency of sampling, the target compounds to be analyzed, and analytical methods will be specified in a workplan or SAP. The current SAP (Appendix A to the RI workplan) describes standard operating procedures for sampling the media of interest for a particular phase of work. If deviations from the SAP are necessary, they will be discussed ahead of time in the appropriate workplan, or in the case of a field modification, will be documented in field notes. Reference to the QAPP will provide field personnel and data reviewers with quantitation goals or other relevant parameters needed for data evaluation.

4.1 Sample Preservation and Handling

Sample containers and methods of preservation for constituents to be tested are listed in the laboratory QAM. A summary is provided in Table B-3. Sample bottles supplied by the laboratory for each sampling event will include the appropriate preservatives. Samples will be preserved and shipped in chilled shipping containers, as required by the analytical method preservation standards. The laboratory will retain documentation on bottle preparation and handling. Bottle storage, preservation, and handling in the field will be documented on FSDSs (Appendix A).

4.2 Sampling Documentation

The documentation to be followed during soil or water sampling is described below. The following information will be recorded on the soil FSDS for each soil or sediment sample collected:

- Facility name
- Sample number

* Sampler's name
* Sample location (well, boring, or sample number)
* Sampling depth
* Sampling date and time
* Sampling method
* Composite or discrete sample
* Sample container size and material
* Sample preservative
* Climatic or other noteworthy conditions (e.g., nearby activities)
* Problems encountered with equipment or methods
* Decontamination methods
* Number of sample bottles filled
* Laboratory used

The sampler will record the following information on the FSDS for each water sample collected:

* Facility name
* Sampler's name
* Blind sample number
* Well/boring/surface site number and location
* Well/boring condition, well depth, depth to water, and date and time of measurement
* Well/boring purging method, volume, depth, date, and time
* Sampling method, depth, date, and time
* Type of sample container and preservative
* Climatic or other noteworthy conditions (e.g., nearby activities)
* Problems encountered with equipment or methods
* Decontamination methods
* Field measurements (pH, specific conductance, temperature, etc.)

- Number of sample bottles filled

- Laboratory used

Sample-Bottle Labels. To prevent bias and tampering, samples will be given a blind sample number. Each sample label will contain the following information:

- Blind sample number
- Sampler identification (person's initials)
- Date and time of sampling
- Place of collection

Blind sample numbers and actual sample locations will be recorded on the FSDSs. The FSDSs will not be sent to the laboratory.

4.3 Decontamination Procedures

All downhole drilling and sampling equipment and related tools, including the back of the drilling machine, will be hot-water, high-pressure washed between boreholes. Hot-water, high-pressure equipment washing will be done at a preapproved decontamination area so that rinsate is contained as appropriate. If severe contamination is present, equipment may require a solvent rinse followed by a second hot-water, high-pressure wash.

All nondedicated groundwater sampling equipment, including water-level and interface probes, will be thoroughly decontaminated before sample collection at each test boring, monitoring well, or surface water site. Treatment washes will be used in the following sequence for decontamination:

- Nonphosphatic detergent and distilled-water wash
- Dilute acid rinse
- Distilled-water rinse
- Dilute reagent-methanol rinse
- Double distilled-water rinse

All soil sampling equipment will be decontaminated before sample collection, using the same washing sequence. Soil adhering to samplers will be removed with a brush.

4.4 Field QA Sample Collection

QA samples will be collected in the field, as specified in the specific SAPs. Samples include field equipment blanks, trip blanks, or field duplicates. QA samples will be blind-labeled and preserved as if they were typical samples. QA samples will be clearly identified on the FSDSs. Analytical results from the blanks and duplicates will facilitate cross-checking of the data. Blank results may indicate possible contamination introduced by field or laboratory procedures, and field duplicates indicate overall precision in both field and laboratory procedures. Results will be evaluated by applying PARCC criteria, and the evaluation will be discussed in the data validation report.

4.4.1 Trip Blanks

Trip blanks are water quality control (QC) samples prepared by the laboratory by filling a water sample container with laboratory-grade, distilled, organic-free, deionized water in the laboratory. Trip blanks will be prepared at the same time and location as the sample containers for a particular sampling event. Trip blanks will accompany the sample containers to and from the event, but at no time will they be opened or exposed to the atmosphere. One trip blank for volatile organic compounds (VOCs) will generally be included per sampling event.

4.4.2 Field Blanks

Field blanks will be prepared in the same manner as trip blanks, but they will be exposed to the ambient atmosphere at a specified monitoring point during sample collection. This is to determine the influence of external field conditions on sample integrity. One field blank for VOCs will generally be included per day of sampling.

Equipment rinsate blanks are another type of field blank. They will be obtained after nondedicated sampling equipment is decontaminated, and will involve passing deionized organic-free water through the sampling equipment and transferring the water into an appropriate sample container. Rinsate blanks will not be collected if single-use or dedicated equipment (e.g., bailers or tubing) is used for sampling. Rinsate blanks will be analyzed to determine whether decontamination of sampling equipment is adequate. One equipment rinsate blank will be collected for every 10 samples collected with nondedicated equipment, or at least one will be collected for each sampling event.

4.4.3 Field Duplicates

A duplicate water sample will be collected to check the precision of groundwater sampling and analytical procedures. During each sampling event, at least one blind duplicate sample will be taken from one sampling point at the same time as the regular sample. Duplicate samples will be obtained by alternately filling like sample bottles for the two sample sets (original and duplicate). One field duplicate sample will be collected for every 10 samples collected. Field duplicates for soil samples will not be collected because the natural heterogeneity of soil samples precludes consistent analytical replication.

4.5 Sample Custody

Sample custody will be tracked from point of origin through final analysis and disposal using chain-of-custody (COC) forms (Appendix A), which will be filled out with the appropriate sample/analytical information as soon as possible after samples are collected. The following items will be recorded on the COC form:

- Project name
- Project number
- IT project manager
- Sampler's name
- Sample number, date and time collected, media, number of bottles submitted
- Requested analyses for each sample
- Shipment method
- Type of data package required (Tier II½ in most cases)
- Turnaround requirements
- Signature, printed name, organization name, date, and time of transfer of all persons having custody of samples
- Additional instructions or considerations that would affect analysis (nonaqueous layers, archiving, etc.)

Persons in possession of the samples will be required to sign and date the COC form whenever samples are transferred between individuals or organizations. The laboratory will implement its in-house custody procedures, which begin when custody transfers to laboratory personnel.

If samples are shipped via air or ground transportation (by a third party), the following custody procedures will be followed. Samples will be packed in shipping containers, and a custody seal will be placed on the container to reduce the potential for tampering. Proper shipping insurance will be requested and the top two copies of the COC form will accompany the samples. The person shipping the samples will retain the third copy of the COC and shipping forms to allow sample tracking. The COC form will accompany the samples from point of origin in the field to the laboratory.

5 FIELD CALIBRATION PROCEDURES

5.1 Field Instrumentation

Several field instruments will be used during the investigations. Field instrument calibration will follow the manufacturers' guidelines, and any deviation from the established guidelines will be documented. All calibration activities will be recorded on field calibration logs that accompany each day of a sampling event. Generally, field instruments will be calibrated daily before work begins. Field personnel may decide to calibrate more than once daily if inconsistent or unusual readings occur, or if conditions warrant more-frequent calibration.

5.1.1 Calibration Procedures and Frequency

Calibration procedures, calibration frequency, and standards for measurement variables and systems will be according to method requirements. To assure that field instruments are properly calibrated and remain operable, the following procedures will be used, at a minimum:

- Operation, maintenance, and calibration will be performed in accordance with the instrument manufacturers' specifications.
- All standards used to calibrate field instruments will meet the minimum requirements for source and purity recommended in the equipment operation manual.
- Acceptable criteria for calibration will be based on the limits set in the operations manual.
- All users of the equipment will be trained in the proper calibration and operation of the instrument.
- Operation and maintenance manuals for each instrument will be brought to the site.
- Field instruments will be inspected before they are taken to the site.

- If used, PID and FID field instruments will be calibrated at the start and end of each work period. Meters will be recalibrated, as necessary, during the work period.

- Specific conductivity and pH meters will be calibrated at the start of each work period. Meters will be recalibrated, as necessary, during the work period.

- Calibration procedures (including time, standards used, and calibration results) will be recorded in a field log book or on FSDSs. Although not reviewed during routine QA/QC, the data will be available if problems are encountered.

5.1.2 Preventive Maintenance

A schedule of preventive maintenance activities will be followed to minimize downtime and ensure the accuracy of measurement systems and the availability of critical spare parts and backup systems and equipment. The preventive maintenance approach for specific pieces of equipment used in sampling, monitoring, and documentation will follow the manufacturers' specifications and good field practices. Maintenance will be documented in the field logbook.

6 ANALYTICAL PROCEDURES

Samples will be analyzed by Columbia Analytical Services, Inc. (CAS), in Kelso, Washington. CAS is qualified to perform the analyses using standard, documented laboratory procedures. The laboratory's QA/QC plans and standard operation procedures provide data quality procedures according to the protocols for the analytical method and cleanup steps. The data quality procedures are at a level sufficient to meet the sampling program's data quality objectives. MOCC/GWCC will determine that any other laboratory used to analyze samples from the site have a QA program, facilities, equipment, and trained staff that meet the data quality objectives specified in the RI workplan and the project QAPP. CAS will perform, document, and report laboratory procedures as described in their QAM. Laboratory QA/QC plans and standard operating procedures will be provided on request.

The analytical methods and references for analyses to be used during project implementation are summarized in Table B-3. Procedural details not specified in this QAPP should follow the protocols described in SW-846 (USEPA, 1986a).

6.1 Internal QA/QC Checks

The laboratory will demonstrate its ability to produce acceptable results using the recommended methods, or their equivalent. The following criteria will be used internally by the laboratory to evaluate the data (as appropriate for inorganic or organic chemical analyses):

- Performance on method tests
  - Matrix spike
  - Gas chromatograph (tailing factors)
  - Blanks
  - Precision of calibration and samples
- Percentage recovery of surrogates (organics)
- Adequacy of detection limits

- Precision of replicate sample analyses
- Comparison of percentage of missing or undetected substances between replicate samples

Laboratory records of standard calibration curves and all other pertinent data will be held for possible inspection at the laboratory, and will be made available on request.

6.2 Preventive Maintenance

Preventive maintenance of equipment is essential if project resources are to be used cost-effectively. Preventive maintenance consists of a schedule of preventive maintenance activities to minimize downtime and ensure the accuracy of measurement systems and the availability of critical spare parts and backup systems and equipment. The preventive maintenance approach for specific pieces of equipment will follow the manufacturers' specifications and good laboratory practices. Maintenance will be documented in the instrument logbooks.

6.3 Laboratory Instrumentation

Specific laboratory instrument calibration procedures, frequency of calibration, and preparation of calibration standards will be according to the method requirements as developed by the USEPA, following procedures recorded in SW-846 (USEPA, 1986a). Copies of QA/QC plans and standard operating procedures for CAS are available on request.

6.4 Data Deliverables

Laboratory data deliverables required for inorganic compound analyses are listed in Table B-4. Data deliverables for organic analyses are listed in Table B-5. Data will be recorded on standard data sheets or in an electronic data deliverable (EDD) format for importing into the site database.

7 DATA REDUCTION, VALIDATION, AND REPORTING

The laboratory performing sample analyses will be required to submit analytical data supported by sufficient QA information to permit independent and conclusive determination of data quality. Data quality will be determined using the data validation procedures described here. The results of the data validation will be used to determine if the data quality objectives are met for the MOCC/GWCC project.

7.1 Reduction

Following validation and assignment of qualifiers, the analytical data will be tabulated in a spreadsheet or database. The tabulation of analytical and field data, with the appropriate data qualifiers, will be stored on computer disk for archival purposes. Data may be further reduced and managed using the following computer software applications:

- Excel (spreadsheet)
- Access (database)
- Word (word processing)
- Surfer (geostatistical contouring)
- Statistical applications using appropriate methods

As an extension of the data evaluation program, data will be reduced to summarize particular data sets. In addition, statistical techniques may be applied to test results. These techniques will help determine the representativeness, comparability, precision, and completeness of the data sets. Reduced data sets will be used in reporting the overall accuracy of the assessment.

7.2 Validation

All laboratory data will be validated. IT will examine the data for precision, completeness, accuracy, and adherence to standard operating procedures. The laboratory will perform internal QC checks and IT will validate laboratory analytical data, as described in the following sections. QC checks will be performed on laboratory information using the sample log-in reports faxed to IT after samples are entered into the laboratory information management system. The reports will be checked early in the process, which will allow QC checks to begin before sample holding times have expired or before errors are incorporated in the laboratory reports.

7.2.1 Validation Procedures

Laboratory analytical data will be reported in a CAS Tier II½ format to facilitate data validation. The items reported by the laboratory in a Tier II½ package include those listed in Tables B-4 and B-5. IT will review data and assign data qualifiers to sample results, following portions of the USEPA procedures for inorganic (USEPA, 1994a) and organic data (USEPA, 1994b). QC criteria not defined in the guidelines for evaluating analytical data are adopted, where appropriate, from the analytical method.

For inorganic and organic analyses, the following information will be reviewed during data validation:

- Sampling locations and blind sample numbers
- Sampling dates
- Requested analysis
- Laboratory service request number(s)
- COC documentation
- Sample preservation
- Holding times
- Method blanks
- Surrogate recoveries (organic analyses only)
- Matrix spike results (inorganics analyses only)
- Matrix spikes/duplicate matrix spike (MS/DMS) analyses (organic analyses only)
- Laboratory duplicates (inorganic analyses only)
- Field duplicates (if submitted)

- Laboratory control samples (organic analyses only)
- MRLs above requested levels
- Any additional comments or difficulties reported by the laboratory
- Overall assessment

The results of the data validation review will be summarized for each batch of samples. Data qualifiers will be assigned to sample results on the basis of USEPA guidelines. The data validation reports will summarize the precision and accuracy for the samples. The quality of the analytical data, as defined by precision and accuracy, will be assessed and compared to data quality objectives for the MOCC/GWCC project.

The laboratories will routinely archive raw laboratory data, including initial and continuing calibration data, chromatograms, quantitation reports, blank sheets, and sampling logs, and will provide these data in addition to the deliverables listed above, if requested.

7.3 Reporting

After completion of data collection, validation, and reduction, the data will be used in reports. Copies of the reports will be kept in the main project file, submitted to MOCC/GWCC for review, then submitted to the regulatory agency as part of reporting requirements specified in the workplan. The original copy of any document that IT produces will remain in the main project file.

8 INTERNAL QUALITY CONTROL

8.1 Laboratory Checks

The laboratory will document the completion and evaluation of internal QC checks and any corrective actions or reanalyses that result.

8.2 Field Checks

Internal QC checks will be performed for field activities. Checks will consist of documentation review of field notes and field activity memoranda to determine whether the specified measurements, calibrations, and procedures are being followed. The need for and content of corrective action will be determined on an ongoing basis, in consultation with the project manager.

8.3 Data Reduction Checks

Data reduction QC checks will be performed on all entered, calculated, and graphic data produced by IT. Data entry will be compared with data generated during field activities and recorded in notebooks or on field data forms. Analytical data entry will be checked against laboratory reports.

9 PERFORMANCE SYSTEM AUDITS

Proper communication between field staff, project management, and the laboratories will be maintained so that consistent and appropriate methods and techniques are used throughout the project. The laboratories will audit in-house performance and systems under their in-house QA/QC guidelines. Such audits will be made available for review on request. Any irregularities found in the performance and systems audits will be dealt with appropriately, as soon as practical.

10 PREVENTIVE MAINTENANCE

Equipment used in the field will be periodically checked to detect any abnormalities. Steps will be taken to repair or replace any piece of equipment that appears unreliable. Repairs will be made according to the manufacturers' guidelines, or by qualified repair technicians. Equipment will also be periodically serviced, according to the manufacturers' recommendations.

Preventive maintenance of analytical equipment is outlined in the laboratory QAM.

11 DATA ASSESSMENT PROCEDURES

Procedures to assess data precision, accuracy, and completeness will be completed routinely, through data validation reports. Precision and accuracy will be based on laboratory documentation. Completeness will be based on the usability of the data collected, relative to the data needs of an investigative task or the amount of data scheduled for collection. Completeness will be quantified when appropriate, but will be qualitatively evaluated with respect to the representativeness of the data when detection, or lack thereof, is the objective. The criteria to be used for analytical data are summarized in Tables B-1 and B-2.

The QAM outlines the precision and accuracy limits for laboratory analytical method and parameter. The laboratory is responsible for assuring that these precision limits are consistently met or exceeded.

12 CORRECTIVE ACTION

The need for corrective action will be evaluated on an ongoing basis, depending on the results of internal and laboratory QC checks.

Corrective action measures will generally result from either instrument failure or nonconformance or noncompliance with QA requirements by laboratories or field personnel. The IT project manager will be notified as soon as practical if a field or laboratory QA problem arises that could jeopardize the use of collected data. All project personnel are responsible for reporting lapses in QA procedures.

During field operation and sampling procedures, field personnel will be responsible for reporting any changes to specified sampling procedures. A description of any such change will be entered in the daily field logbook, or on FSDSs.

Corrective action will be taken by the IT project manager when analytical data are found to be outside the predetermined limits of acceptability. Corrective actions could include a procedural change, additional performance and system audits, meeting with laboratory personnel, resampling, or in extreme cases, obtaining a new subcontractor. The regulatory agencies will be notified if a substantive deviation from the workplan results in a corrective action.

All fixed laboratories will be required to meet USEPA data validation guidelines and to provide full documentation and annotation of data submitted. Raw data will be made available on request for data-proofing procedures.

After review and evaluation of each analytical data package, data validation problems and corrective actions will be listed and summarized, with a determination of their impact on the data. It is impractical to specify specific responses in this plan, since data errors are indeterminate. If data do not conform to the guidelines and cannot be validated, they will be either annotated or discarded before the overall project is evaluated.

13 QA REPORTS TO MANAGEMENT

Reporting on the quality of data gathering will include regularly transmitting field and laboratory documentation to the project manager, and summarizing the information. These reports will consist of field activity memoranda and reports and data validation reports, and will provide a means for management to evaluate accomplishment of the established QA/QC objectives. The reports will be maintained in the project files and will include results of performance and system audits; periodic assessment of measurement data accuracy, precision, and completeness; significant QA/QC problems and recommended solutions; and resolutions of previously identified problems.

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TABLES

Table B-1
Objectives for Measurement
Quality Assurance Project Plan
McCall Oil and Chemical Corporation

Analysis	Matrix	Units	Limit of Detection[a]	Accuracy (%REC)	Precision (RPD)	Completeness	Method[b]	Reference[c]	Maximum Holding Time
Volatiles									
Method 8260B	Water	µg/L	0.2 – 3.0	—[d]	30	85%	Purge+Trap GC/MS	SW-846	14 days
	Soil	µg/kg	5-20	—[d]	40	85%	Purge+Trap GC/MS	SW-846	14 days
PAHs/Semivolatiles									
Method 8270B-SIM	Water	µg/L	0.002 – 0.007	—[d]	30	85%	Extraction - GC/MS-SIM	SW-846	7 days until extraction, 40 days after extraction
Method 8270B-SIM	Soils	mg/kg[e]	0.3 - 2	—[d]	40	85%	Extraction - GC/MS-SIM	SW-846	14 days until extraction, 40 days after extraction
Metals									
Method 200.8	Water	µg/L	0.02-0.5	85-115	20	85%	Digestion – ICP-MS	SW-846	6 months
Method 200.8	Soils	mg/kg[e]	0.05 – 0.5	70-130	30	85%	Digestion - ICP-MS	SW-846	6 months
TPH									
Method 8015B	Water	µg/L	100-250	39-117	30	85%	GC-FID	SW-846	14 days
Method 8015B	Soils	mg/kg[e]	10-25	19-145	40	85%	GC-FID	SW-846	14 days

NOTE:
[a] Detection limits will be elevated if sample requires dilution or matrix interferences are a problem.
[b] GC = gas chromatograph; MS = mass spectrometer; ICP = inductively coupled plasma (ICPAES = ICP atomic emission spectrometry); SIM = selective ion monitoring; FID = flame ionization detector.
[c] SW-846 (USEPA, 1986a) provides routine analyses for these substances (updates: I [1992], II[1994]).
[d] QA/QC limits for accuracy (%REC) vary for each organic analyte and are specified in SW-846 for each analytical method (i.e., 8260B, 8270B).
[e] Dry weight basis.

Table B-2

Method Reporting Limit Goals

Quality Assurance Project Plan
McCall Oil and Chemical Corporation

Analysis (Method) Analyte	Quantitation Limits[a,b] Soil/Sediment (units)	Water (units)
Volatile Organic Compounds (Method 8260B[c]/GC-MS)	(µg/kg)	(µg/L)
Bromochloromethane	5	0.5
Bromodichloromethane	5	0.5
Bromoform	5	0.5
Bromomethane	5	0.5
Carbon tetrachloride	5	0.5
Chlorobenzene	5	0.5
Chloroethane	5	0.5
2-Chloroethyl Vinyl Ether	5	0.5
Chloroform	5	0.5
Chloromethane	5	0.5
1,1-Dichloroethane	5	0.5
1,1-Dichloroethene	5	0.5
1,2-Dichlorobenzene	5	0.5
1,2-Dichloroethane	5	0.5
1,2-Dichloropropane	5	0.5
1,3-Dichlorobenzene	5	0.5
1,4-Dichlorobenzene	5	0.5
cis-1,2-Dichloroethene	5	0.5
cis-1,3-Dichloropropene	5	0.5
trans-1,2-Dichloroethene	5	0.5
trans-1,3-Dichloropropene	5	0.5
Dibromochloromethane	5	0.5
Dichlorodifluoromethane	5	0.5
Methylene chloride	10	1
Tetrachloroethene	5	0.5
1,1,1-Trichloroethane	5	0.5
1,1,2,2-Tetrachloroethane	5	0.5
1,1,2-Trichloroethane	5	0.5
Trichloroethene	5	0.5
Trichlorofluoromethane	5	0.5
Trichlorotrifluoroethane	5	0.5
Vinyl chloride	5	0.5
Base Neutral Acid Extractables (Method 8270B-SIM)	(µg/kg)	(µg/L)
4-methylphenol	5	0.02
Butylbenzylphthalate	5	0.02
Di-n-octylphthalate	5	0.02
Dibenzofuran	5	0.02

Table B-2

Method Reporting Limit Goals

Quality Assurance Project Plan
McCall Oil and Chemical Corporation

Analysis (Method) Analyte	Quantitation Limits[a,b] Soil/Sediment (units)	Water (units)
PAHs (Method 8270B/GC/MS-SIM)	(µg/kg)	(µg/L)
Acenaphthene	5	0.02
Acenaphthylene	5	0.02
Anthracene	5	0.02
Benz(a)anthracene	5	0.02
Benzo(a)pyrene	5	0.02
Benzo(b)fluoranthene	5	0.02
Benzo(k)fluoranthene	5	0.02
Benzo(g,h,i)perylene	5	0.02
Chrysene	5	0.02
Dibenzo(a,h)anthracene	5	0.02
Dibenzofuran	5	0.02
Fluoranthene	5	0.02
Fluorene	5	0.02
Indeno(1,2,3-cd)pyrene	5	0.02
2-Methylnaphthalene	5	0.02
Napthalene	5	0.02
Phenanthrene	5	0.02
Pyrene	5	0.02
Total Petroleum Hydrocarbons (Method 8015B)	(mg/kg)	(µg/L)
TPH-diesel range hydrocarbons	10	100
TPH-heavy oil-range hydrocarbons	25	250
Metals (Method 6020 ICP-MS)	(mg/kg)	(µg/L)
Arsenic	0.5	0.5
Cadmium	0.05	0.05
Chromium	0.2	0.2
Copper	0.1	0.1
Lead	0.05	0.02
Zinc	0.5	0.5

NOTE:

[a] Quantitation limits derived from "Test Methods for Evaluating Solid Waste," SW-846 (USEPA, 1986a).

[b] Specific quantitation limits are matrix-dependent. Quantitation limits listed are provided for guidance and may not always be achievable.

[c] Method 8260B will be used for VOC analyses. The 8010B analyte list for chlorinated VOCs will be reported.

Table B-3

Sample Analyses, Containers, Preservation, and Holding Times
Quality Assurance Project Plan
McCall Oil and Chemical Corporation

Matrix	Parameter	Container Type	Preservation and Handling	Holding Time
Soil	VOCs	Two 4-oz glass jars; PTFE[a]-lined silicon cap	Fill, minimum air space; store in dark; cool to 4°C	14 days
	Semivolatile Organics, PAHs	8-oz glass jar; PTFE-lined lids	Cool to 4°C	14 days sampling to extraction; 40 days extraction to analysis
	TPH	8-oz glass jar; PTFE-lined lids	Cool to 4°C	14 days
	Total Metals	8-oz glass	Cool to 4°C	6 months
Water	VOCs	Three 40 ml glass vials; PTFE-lined silicon septum caps	Fill, leaving no air space; store in dark; cool to 4°C, HCl to pH<2	14 days
	Semivolatile Organics, PAHs	1-liter amber glass; PTFE-lined cap	Cool to 4°C	7 days sampling to extraction; 40 days extraction to analysis
	TPH	1-liter amber glass; PTFE-lined cap	Cool to 4°C, HC1 to pH<2	7 days
	Dissolved or Total Metals	500 ml poly	Field filter (if dissolved); HNO_3 to pH<2; cool to 4°C	6 months

[a] Polytetrafluoroethylene (Teflon).

Table B-4

Documentation Requirements for Independent QA/QC Review of Inorganic Substances Data Quality Assurance Project Plan McCall Oil and Chemical Corporation

Analysis of the requested inorganic analytes should be reported as follows:

- Dates samples were collected, received by the laboratory, and analyzed.
- On each laboratory sample data sheet: method of detection (e.g., AA, ICP).
- On each laboratory sample data sheet: a tabulation of method detection limits (MDLs) or method reporting limits (MRLs), or a master sheet of MDLs or MRLs with detection limit multiplication factors (due to dilutions or dry weights) specified.
- Constituent concentrations reported in µg/L or mg/kg for water and µg/kg or mg/kg for soil (dry-weight basis) for each sample analyzed.
- Volumes analyzed and dilution factors, if any.
- Ancillary information, including percent moisture in soil samples.
- Method blank data associated with each sample.
- Results for matrix spike analyses, concentrations added, and percent recovery from samples.
- Results of laboratory duplicate or laboratory control sample analyses for each constituent, as applicable to the method.
- A statement in the cover letter describing how standard calibration curves were generated and applied to the samples for quantitation (and access to laboratory records of standard calibration curves and all other pertinent data for possible inspection), if this varies from the method specified in SW-846 (USEPA, 1986a).
- A statement in the cover letter describing any significant problems in any aspect of sample analysis, deviation from prescribed QA/QC criteria, or other relevant information. A statement in the cover letter describing any changes or deviations from the required methods, the reason for the change(s), and a description of the deviations that were used for sample analysis.
- A copy of the chain-of-custody form for each sample reported.

Table B-5

Documentation Requirements for Independent QA/QC Review of Organic Substances Data Quality Assurance Project Plan McCall Oil and Chemical Corporation

Analytical laboratory reports for organic substances, including volatile organic compounds, semivolatile organic compounds, and chemically similar compounds, should be reported as follows:

- Dates samples were collected, received by the laboratory, and analyzed.
- On each laboratory sample data sheet: method of detection (e.g., GC, HPLC).
- On each laboratory sample data sheet: a tabulation of method detection limits (MDLs) or method reporting limits (MRLs), or a master sheet of MDLs or MRLs with detection limit multiplication factors (due to dilutions or dry weights) specified.
- Constituent concentrations reported in milligrams per liter (mg/L) or micrograms per liter (µg/L) for water, and milligrams per kilogram (mg/kg) or micrograms per kilogram (µg/kg) for soil (dry-weight basis) for each sample analyzed.
- Volumes analyzed and dilution factors, if any.
- Ancillary information, including percent moisture in soil samples.
- With each sample, complete data for associated method blanks.
- Surrogate recoveries for analyses reported as percent recoveries.
- Results for matrix spike and matrix spike duplicate analyses, concentrations added, percent recovery, and relative percent difference.
- A statement in the cover letter describing how standard calibration curves were generated and applied to the samples for quantitation (and access to laboratory records of standard calibration curves and all other pertinent data for possible inspection), if this varies from the method specified in SW-846 (USEPA, 1986a).
- A statement in the cover letter describing any significant problems in any aspect of sample analysis, deviation from prescribed QA/QC criteria, or other relevant information. A statement in the cover letter describing any changes or deviations from the required methods, the reason for the change(s), and a description of the deviations that were used for sample analysis.
- A copy of the chain-of-custody form for each sample analyzed.

APPENDIX A

FORMS

FIELD SAMPLING DATA SHEET

the group
15055 SW Sequoia Parkway, Suite 140
Portland, Oregon 97224-7712
Office: (503) 624-7200 Fax: (503) 620-7658

PROJECT NAME: McCall Oil and Chemical Corporation **WELL ID:**

SITE ADDRESS: Portland, OR **BLIND ID:**

DUP ID: NA

WIND FROM:	N	NE	E	SE	S	SW	W	NW	LIGHT	MEDIUM	HEAVY
WEATHER:	SUNNY		CLOUDY		RAIN			?	TEMPERATURE:	°F .	°C

[Circle appropriate units]

HYDROLOGY/LEVEL MEASUREMENTS (Nearest 0.01 ft)

Date	Time	DT-Bottom	DT-Product	DT-Water	DTP-DTW [Product Thickness]	DTB-DTW [Water Column]		Volume (gal) [Water Column x Gal/ft]
/ /	:	.	.	.	.	.	X 1	.
/ /	:	.	.	.	.		X 3	.

Gal/ft = $(dia./2)^2 \times 0.163$	1" =	0.041	2" =	0.163	3" =	0.367	4" =	0.653	6" =	1.469	10" =	4.080	12" =	5.875

§ METHODS: (A) Submersible Pump (B) Peristaltic Pump (C) Disposable Bailer (D) PVC/Teflon Bailer (E) Dedicated Bailer (F) Dedicated Pump (G) Other =

GROUNDWATER SAMPLING DATA (if product is detected, do NOT sample)

Sample Depth:

Bottle Type	Date	Time	Method §	Amount & Volume mL		Preservative [circle]	Ice	Filter	pH	√ [√ if used]
VOA Glass	/ /	:		3	40 ml	HCl	YES	NO		
Amber Glass	/ /	:			250, 500, 1L	(None) (HCl) (H_2SO_4)	YES	NO		
White Poly	/ /	:			250, 500, 1L	None	YES	NO	NA	
Yellow Poly	/ /	:			250, 500, 1L	H_2SO_4	YES	NO		
Green Poly	/ /	:			250, 500, 1L	NaOH	YES	NO		
Red Total Poly	/ /	:			250, 500, 1L	HNO_3	YES	NO		
Red Diss. Poly	/ /	:			250, 500, 1L	HNO_3	YES	YES		
	/ /	:			250, 500, 1L		YES			
		Total Bottles (include duplicate count):								

Analysis Allowed per Bottle Type	BOTTLE TYPE	TYPICAL ANALYSIS ALLOWED PER BOTTLE TYPE (Circle applicable or write non-standard analysis below)
	VOA - Glass	(8010) (8010/8020) (8020) (8240) (8260) (BTEX) (TPH-G) (BTEX/TPH-G) OR [ ] WA [ ]
	AMBER - Glass	(PAH) (TPH-HCID) (TPH-D) (TPH-418.1) (Oil &Grease) OR [ ] WA [ ]
	WHITE - Poly	(pH) (Conductivity) (TDS) (TSS) (BOD) (Turbidity) (Alkalinity) (HCO_3/CO_3) (Cl) (SO_4) (NO_3) (NO_2) (F)
	YELLOW - Poly	(COD) (TOC) (Total PO_4) (Total Keldahl Nitrogen) (NH_3) (NO_3/NO_2)
	GREEN - Poly	(Cyanide)
	RED TOTAL - Poly	(As) (Sb) (Ba) (Be) (Ca) (Cd) (Co) (Cr) (Cu) (Fe) (Pb) (Mg) (Mn) (Ni) (Ag) (Se) (Tl) (V) (Zn) (Hg) (K) (Na)
	RED DISSOLVED - Poly	(As) (Sb) (Ba) (Be) (Ca) (Cd) (Co) (Cr) (Cu) (Fe) (Pb) (Mg) (Mn) (Ni) (Ag) (Se) (Tl) (V) (Zn) (Hg) (K) (Na) (Hardness) (Silica)

WATER QUALITY DATA

Purge Start Time: : Pump/Bailer Inlet Depth:

Meas. [Casing]	Method § [Select A-G]	Purged (gal) [Cumulative Totals]	pH	E Cond (µS)	Temp °C	Other	Diss O_2 (mg/l)	Water Quality [Clarity, Color]
4		.	.		.		.	
3		.	.		.		.	
2		.	.		.		.	
1		.	.		.		.	
0		0.00	.		.		.	

SAMPLER: ______________________ ______________________

(PRINTED NAME) (SIGNATURE)

the group

Soil/Sediment Field Sampling Data

Location/Address		Boring Number	
Boring Location		Sampler	
Project Name	#	Date, Time	
Client/Contact		Weather	

Sample Number	Depth Interval Top/Bottom (ft)	Sample Type	Sampling Method	Comments Bottle Size & Number

N\Data\Projects\Geology\Forms\Soil-fielddata.xls

Columbia Analytical Services INC.
An Employee-Owned Company

CHAIN OF CUSTODY

SR#: ____________

1317 South 13th Ave. • Kelso, WA 98626 • (360) 577-7222 • (800) 695-7222 • FAX (360) 636-1068

PAGE ______ OF ______ COC # ____________

PROJECT NAME

PROJECT NUMBER

PROJECT MANAGER

COMPANY/ADDRESS

PHONE # | FAX #

SAMPLER'S SIGNATURE

SAMPLE I.D.	DATE	TIME	LAB I.D.	MATRIX	NUMBER OF CONTAINERS	Semivolatile Organics by GC/MS 625☐ 8270☐	Volatile Organics 624☐ 8260☐ 8021☐ BTEX☐	Pesticide / Herbicides 608☐ 8081☐ 8141☐ 8151☐	Total Toxic Organics (TTO) 608☐ 624☐ 625☐	PCB AROCLORs 8082	NWTPH - HCID☐ NWTPH-D☐ NWTPH-G☐	Hydrocarbon Scan☐ O & G☐	Chlorophenolics - 8151M Tri☐ Tetra☐ PCP☐	PAHs 8310☐ SIM☐	GC/MS-SIM PAH☐ Phenol☐ Phthalates☐	Metals, Total or Dissolved (See list below)	Cyanide☐ Hex-Chrom☐	pH, Cond., Cl, SO4, PO4, F, NO_2, NO_3, BOD, TSS, TDS (circle)	NH_3-N, COD, Total-P, TKN, TOC, DOC (circle)	TOC 9020☐ AOX 1650☐ 506☐				REMARKS

REPORT REQUIREMENTS

___ I. Routine Report: Method Blank, Surrogate, as required

___ II. Report Dup., MS, MSD as required

___ III. Data Validation Report (includes all raw data)

___ IV. CLP Deliverable Report

___ V. EDD

INVOICE INFORMATION

P.O. # ____________

Bill To: ____________

____

____

TURNAROUND REQUIREMENTS

___ 24 hr. ___ 48 hr.

___ 5 Day

___ Standard (10-15 working days)

___ Provide FAX Results

____

Requested Report Date

Circle which metals are to be analyzed:

Total Metals: Al As Sb Ba Be B Ca Cd Co Cr Cu Fe Pb Mg Mn Mo Ni K Ag Na Se Sr Tl Sn V Zn Hg

Dissolved Metals: Al As Sb Ba Be B Ca Cd Co Cr Cu Fe Pb Mg Mn Mo Ni K Ag Na Se Sr Tl Sn V Zn Hg

SPECIAL INSTRUCTIONS/COMMENTS:

RELINQUISHED BY:	RECEIVED BY:	RELINQUISHED BY:	RECEIVED BY:
Signature / Date/Time	Signature / Date/Time	Signature / Date/Time	Signature / Date/Time
Printed Name / Firm	Printed Name / Firm	Printed Name / Firm	Printed Name / Firm

APPENDIX C
HEALTH AND SAFETY PLAN

IT CORPORATION
A Member of The IT Group

SITE SPECIFIC HEALTH & SAFETY PLAN

Note: This Site Specific Health & Safety Plan must be re-evaluated and updated annually or when site conditions or scope of work changes.

McCall Oil and Chemical Corporation

Location: Portland, Oregon **Date: 9/15/00**
Project Manager: Eric Tuppan **Project: 807595**

SITE DESCRIPTION: The site is located in the industrialized area of northwest Portland along NW Front Avenue. It occupies approximately 36 acres on the southwest bank of the Willamette River.

The property is currently occupied by two separate facilities: McCall Oil and Chemical Corporation (MOCC), which operates a marine terminal and asphalt facility, and Great Western Chemical Corporation (GWCC), which operates a chemical distribution facility. The site and surrounding properties are zoned for heavy industrial use. Surrounding industries include: petroleum bulk distribution terminals, chemical plants, sand and gravel operations, a steel fabrication facility, shipyards, and rail yards

SCOPE OF WORK

IT personnel will be responsible for the oversight of boring advancement, piezometer and well installation, soil and groundwater monitoring, and aquifer testing.

Note: As the scope of work changes the HASP will be modified to address any new hazards.

EMPLOYEE AND CONTRACTOR RESPONSIBILITIES

Each person is responsible for his/her own health and safety, for completing tasks in a safe manner and for reporting any unsafe acts or conditions to his/her supervisor and the Project Manager (PM). All persons on-site are responsible for continuous adherence to health and safety procedures during the performance of any project work. In no case may work be performed in a manner which conflicts with the intent of, or the inherent safety precautions expressed in, this HASP. After due warning, persons who violate procedure and work rules may be dismissed from the site, terminated, or have their contract revoked. Blatant disregard or repeated infractions of health and safety policies are grounds for disciplinary action up to, and including, dismissal, and/or removal from the project.

All IT and subcontractor personnel are required to read and acknowledge their understanding of this HASP. All project personnel are expected to abide by the requirements of this HASP and cooperate with project management and safety representatives in ensuring a safe and healthful work site. Site personnel are required to immediately report any of the following to the PM:

- Accidents and injuries, no matter how minor;
- Unexpected or uncontrolled release of chemical substances;
- Any sign or symptoms of chemical exposure;
- Any unsafe or malfunctioning equipment; and
- Any changes in site conditions which may affect the health and safety of project personnel.

SITE CONTROL

This project requires that access to the site be controlled to protect both the worker and the public. This access control may require fences, barricades, traffic control devices, use of flaggers, caution tape, and other methods to keep the site secure and provide a visual barrier to help keep the curious or unaware public from entering the site and active work areas.

TRAINING AND MEDICAL SURVEILLANCE REQUIREMENTS

All personnel conducting site work shall have completed at least 24 hours of classroom-style health and safety training and 1 day of on-site training, as required by OSHA 29 CFR 1910.120. In addition, the Site Supervisor or PM shall have received an additional 8 hours of supervisory training. IT employees shall also be current in their annual refresher training and enrolled in a medical monitoring program in accordance with 29 CFR 1910.120(f).

SITE HEALTH AND SAFETY INFORMATION:

Potential Chemical Hazards

- Chemical hazards include volatile organic compounds (VOCs), semi-VOCs, polynuclear aromatic compounds (PAHs), and metals (copper, chromium, and arsenic).

TABLE 1 - POTENTIAL SITE CONTAMINANTS

Potential Site Contaminants	Concentration at site in groundwater (µg/L)	PEL-TWA
VOCs:		
1,1-DCE	22	NE
TCA	310	350 (µg/L)
TCE	470	100 (µg/L)
PCE	3600	100 (µg/L)
PAHs	Unknown	NE
Metals:		
Arsenic	600	NE
Copper	5,300	1 mg/m^3
Chromium	55,000	1 mg/m^3
SVOCs:	Unknown	
4-methylphenol		5 mg/L
Butylbenzylphthalate		NE
Di-n-octylphthalate		NE
Dibenzofuran		NE

NE = Not established

Physical Hazards

The physical hazards associated with the project scope primarily involve exposure to drilling operations, heavy equipment, overhead utilities, noise, slip/trip/fall hazards, and temperature stress. Safety procedures and guidelines for these hazards are attached to this plan.

SITE PERSONNEL PROTECTION REQUIREMENTS

As site activities progress, levels of PPE are subject to change or to modification. Upgrading of PPE can occur when action levels are exceeded or whenever the need arises to protect the safety and health of site personnel. Levels of PPE will not be downgraded without prior approval from the Project Health and Safety Manager.

The initial level for all site activities is Level D.

TABLE 2 – PROTECTION LEVELS

ACTIVITY	LEVEL OF PROTECTION	EQUIPMENT REQUIREMENTS
General Site Activities	D	Work clothing, hard hat, steel-toed work boots, and eye protection, Wear traffic vests if the potential exists for vehicular traffic is in the area.

EXPOSURE MONITORING

Exposure monitoring shall be conducted using a photoionization detector (PID) whenever visible sheens or product odors are present. The exposure monitoring shall be conducted in the workers breathing zone every 15 minutes, or other appropriate interval while odors or visible sheens exist, and readings recorded in a field notebook.

If air concentrations of volatile organic vapors (VOCs) in the worker's breathing zone (BZ) should meet or exceed 10 ppm for a time period greater than 15 minutes, workers will be required to upgrade to Level C personal protective equipment, including the use of air-purifying respirators (equipped with organic vapor/HEPA cartridges).

Upgrade to Level C protection immediately if VOC concentrations exceed 25 ppm in the worker's BZ. If organic vapor concentrations drop back down below 10 ppm, the level of personal protective equipment may be downgraded to Level D protection.

If VOC concentrations in the worker's BZ exceed 50 ppm, the area must be evacuated and allowed to ventilate to less than 50 ppm in the BZ. Use portable blowers and work upwind to minimize BZ VOC concentrations. Level B protection must be used to continue work when BZ VOC concentrations are greater than 50 ppm. Additional personnel respiratory training and an addendum to this HASP are required for Level B activities. Contact the Project Health and Safety Manager if Level B protection is needed.

TABLE 3 – EXPOSURE MONITORING ACTION LEVELS

ACTIVITY	INSTRUMENT**	ACTION LEVEL*	LEVEL OF PROTECTION
General site activities,	Use a PID to conduct exposure monitoring whenever product odors or visible sheens are present.	10 ppm or greater in the BZ for > 15 minutes	C
		> 25 ppm	C
		50 ppm	Evacuate Area, contact Project H&S Manager, upgrade to level B protection prior to continuing

*Action levels should be based on OSHA PEL's. **Monitoring instruments shall be calibrated and maintained according to manufacturers specifications and at a minimum calibration shall occur once daily.

The discovery of any condition that would suggest the existence of a situation more hazardous than anticipated shall result in the evacuation of site personnel and re-evaluation by the safety officer and project manager of the hazard and the level of protection.

DECONTAMINATION:

Procedures for decontamination must be followed to prevent the spread of contamination and to eliminate the potential for chemical exposure.

1. Equipment - All equipment must be decontaminated or discarded upon exit from the exclusion zone.

2. Personnel - Decontamination will take place prior to exiting the exclusion zone.

LEVEL D Decontamination - Wash and rinse gloves (if any) and remove. Wash hands and face.
LEVEL C Decontamination -Wash and rinse outer gloves, boots and suit, and air-purifying respirator; wash respirator; remove inner gloves (if any) and dispose. Wash hands and face.
Handle all clothing inside out when possible

Emergency Response

Emergencies can range from minor to serious conditions. Various procedures for responding to site emergencies are listed in this section. The Site Manager, Project Manager or the site Safety Officer is responsible for contacting local emergency services in emergency situations. Various individual site characteristics will determine preliminary action to be taken to assure that these emergency procedures are successfully implemented in the event of an emergency.

Accident, Injury, and Illness Reporting and Investigation

IT employees are required to immediately report to their direct supervisor all occupational injuries, illnesses, accidents, and near miss incidents having the potential for injury. Any supervisor (but preferably the supervisor directly responsible for the involved employees) with first-hand knowledge of an incident is required to:

- Immediately arrange for appropriate medical attention and notify the responsible health and safety representative.
- Inform Continuum Healthcare of all incidents requiring medical attention by calling 1-800-229-3674, Extension 303, and providing the following information:

  Employee name
  Name of treating medical facility and phone number
  Brief description of incident

- Complete Continuum Healthcare's *Authorization for Treatment, Release of Medical Information, and Return to Work* for all cases requiring medical attention.

For detailed reporting procedures refer to IT procedure HS020 Accident Prevention Program: Reporting, Investigation, and Review. Injury and/or incident reports, including those involving motor vehicles, must be submitted to the appropriate health and safety representative within one business day of the incident.

Sub-contractor employees shall notify their supervisors and the associated IT Project Manager of any incidents or injuries while engaged in an IT project.

Emergency Procedures for Contaminated Personnel

Whenever possible, personnel should be decontaminated in the contamination reduction zone before administering first aid.

Skin Contact — Remove contaminated clothing, wash immediately with water, use soap, if available.

Inhalation — Remove victim from contaminated atmosphere. Remove any respiratory protection equipment. Initiate artificial respiration, if necessary. Transport to the hospital.

Ingestion — Remove from contaminated atmosphere. Do not induce vomiting if victim is unconscious. Also never induce vomiting when acids, alkalis, or petroleum products are suspected. Transport to the hospital, if necessary.

Emergency Equipment/First Aid

The emergency equipment to be located on site either in site trailers or company vehicles includes a 10 unit first aid kit, emergency alarm (i.e., air horn), emergency eyewash, an ABC fire extinguisher, potable water, anti-bacterial soap, and telephone/walkie-talkies.

Site Evacuation

In the event of an emergency situation such as fire, explosion, significant release of toxic gases, etc., an air horn or other appropriate device will be sounded for approximately 10 seconds indicating the initiation of evacuation procedures. Personnel in the field will be notified through radio communications to evacuate the area. All personnel in both the restricted and non-restricted area will evacuate and assemble near the Support Zone or other safe area as identified by the SSO prior to the beginning of field operations. The location shall be upwind of the site, if possible.

Spill and Release Contingencies

If a spill has occurred, the first step is controlling the spread of contamination if possible. The site Safety Officer will immediately contact site management to inform them of the spill and activate emergency spill procedures.

EMERGENCY CONTACT INFORMATION

EMERGENCY INFORMATION		
Contact	**Phone Number**	**Hospital Directions**
Local Police	911	**Hospital:** Legacy Good Samaratin Hospital 1015 NW 22nd Ave Portland, OR
Fire Department	911	
Ambulance	911	
Local Hospital:	(503) 413-7119	**Hospital Directions and Route Maps on next page.**
Health and Safety Coordinator, IT Patrick Moore Work Home HASP Review: ____________	 (425) 485-5000 (206) 417-0601	IT- EMCON INCIDENT REPORTING SYSTEM Please call Continuum Healthcare at 1-800-229-3674 ext. 303 for any incidents involving medical attention and provide: • Employee name • Name of treating facility and phone number • Description of incident
Project Manager, IT Eric Tuppan Work	 (503) 624-7200	
Site Contact John Golightly	 (503) 228-2644	
Client Contact Lee Zimmerli	 (503) 228-2600 x276	

HOSPITAL DIRECTIONS AND ROUTE MAPS

Starting From: (Point S on map).

Arriving At: (Point E on map).

Distance: 3.6 miles **Approximate Travel Time:** 9 minutes

Driving Directions:

- Head SE on NW FRONT AVE towards NW KITTRIDGE AVE.
- Turn RIGHT on NW KITTRIDGE AVE.
- NW KITTRIDGE AVE becomes NW ST HELENS RD.
- NW ST HELENS RD becomes NW NICOLAI ST.
- Turn SLIGHT RIGHT onto NW WARD WAY.
- NW WARD WAY becomes NW VAUGHN ST.
- Turn RIGHT onto NW 23RD AVE.
- Turn LEFT onto NW LOVEJOY ST.
- Turn LEFT onto NW 22ND AVE.

(b)(4) copyright

health and safety plan
sign-off form

PROJECT: MCCALL OIL AND CHEMCIAL CORPORATION
PROJECT NO. 807595

The Project Manager shall sign this form after she/he has conducted a pre-entry briefing.

Each IT employee, and subcontractor, conducting field work shall sign this form after the pre-entry briefing is completed and prior to commencing work on site. A copy of this signed form shall be kept at the site, and the original sent to the project manager, for inclusion into the project file.

Site Personnel Sign-off

☐ I have received a copy of the Site-Specific Health and Safety Plan.

☐ I have read the Plan and will comply with the provisions contained therein.

☐ I have attended a pre-entry briefing outlining the specific health and safety provisions on this site.

Name: ______________________________ Date: __________
______________________________ Date: __________
______________________________ Date: __________
______________________________ Date: __________
______________________________ Date: __________
______________________________ Date: __________

IT Project Manager

☐ A pre-entry briefing has been conducted by myself on __________.

☐ I deferred the pre-entry briefing responsibility to the Health and Safety Officer.

Name: ______________________________ Date: __________

SAFETY PRACTICES FOR FIELD PERSONNEL

Field operations for this project shall be conducted in accordance with the minimum safety practices described below required for all IT employees.

- Eating, drinking, chewing gum or tobacco, smoking, or any practice that increase the probability of hand-to-mouth transfer and ingestion of materials is prohibited in any area where the possibility of contamination exists.

- Hands must be thoroughly washed when leaving a contaminated or suspected contaminated area before eating, drinking, or any other activities.

- Contaminated protective equipment shall not be removed from the work area until it has been properly decontaminated or containerized on site.

- Avoid activities which may cause dust. Removal of materials from protective clothing or equipment by blowing, shaking, or any means which may disperse materials into the air is prohibited.

- Field personnel must use the "buddy system" when wearing any respiratory protective devices. Communications between members must be maintained at all times. Emergency communications shall be prearranged in case unexpected situations arise. Visual contact must be maintained between pairs on site, and team members should stay close enough to assist each other in the event of an emergency.

- Personnel should be cautioned to inform each other of subjective symptoms of chemical exposure such as headache, dizziness, nausea, and irritation of the respiratory tract.

- No excessive facial hair which interferes with a satisfactory fit of the facepiece-to-face seal will be allowed on personnel required to wear respiratory protective equipment.

- The selection, use, and maintenance of respiratory protective equipment shall meet the requirements of established IT procedures, recognized consensus standards (AIHA, ANSI, NIOSH), and shall comply with the requirements set forth in 29 CFR 1910.134.

- At sites with known or suspected contamination, appropriate work areas for field personnel support, contaminant reduction, and exclusion will be designated and maintained.

- IT field personnel are to be thoroughly briefed on the anticipated hazards, equipment requirements, safety practices, emergency procedures, and communications methods, both initially and in daily briefings.

SAFETY PRACTICES FOR FIELD PERSONNEL (continued)

- All IT field vehicles shall contain a first aid kit and multipurpose portable fire extinguisher.
- All field personnel will, whenever possible, remain upwind of drilling rigs, open excavations, boreholes, etc.
- Subsurface work shall not be performed at any location until the area has been cleared by a utility locator firm to be free of underground utilities or other obstructions.
- Field personnel are specifically prohibited from entering into excavations, trenches, or other confined spaces deeper than 4 feet. Unattended boreholes must be properly covered or otherwise protected.

DRILLING SAFETY

The following practices shall be adhered to by drilling personnel:

- Equipment should be inspected daily by the operator to ensure that there are no operational problems.
- Before leaving the controls, shift the transmission controlling the rotary drive into neutral and place the feed level in neutral. Before leaving the vicinity of the drill, shut down the drill engine.
- Do not drive the drill rig with the mast in the raised position.
- Before raising the mast, check for overhead obstructions.
- Before the mast of a drill rig is raised, the drill rig must first be leveled and stabilized with leveling jacks and/or cribbing. Re-level the drill rig if it settles after initial set up. Lower the mast only when the leveling jacks are down, and do not raise the leveling jack pads until the mast is lowered completely.
- Employees involved in the operation shall not wear any loose-fitting clothing which has the potential to caught in moving machinery.
- During freezing weather, do not touch any metal parts of the drill rig with exposed flesh. Freezing of moist skin to metal can occur almost instantaneously.
- Adequately cover or protect all unattended boreholes to prevent drill rig personnel or site visitors from stepping or falling into the borehole
- Personnel shall wear steel-toed shoes, safety glasses, hearing protection and hard hats during drilling operations.

- The area shall be roped off, marked or posted, to keep the area clear of pedestrian traffic or spectators.

- All personnel should be instructed in the use of the emergency kill switch on the drill rig.

HAND TOOLS

Use of hand tools may expose workers to cuts, lacerations or puncture wounds if adequate hand protection is not worn or tools are improperly used or stored. Damaged hand tools may also expose employees to injuries from shattered tools and flying debris.

The following safe work practices apply to the use of hand tools:

- Only use a tool for its designed use.
- Do not use damaged tools.
- Driving faces of hammers, chisels, drift pins, bars, and similar tools must be inspected to eliminate mushroomed heads, broken faces and other defects.
- Tools must be returned to their proper storage place.
- Sharp tools must not be carried in pockets.
- Wood handles must be sound and securely wedged or fastened to the tool. Tape must not be used to cover defects such as cracks.
- When hand tools are being used overhead, those working or standing below must be notified.
- Pipe wrenches must be inspected regularly. Replace the heel and jaw sections if found to be defective or worn out.
- Pipe wrenches must not be used to bend, raise or lift pipe.
- Always wear safety glasses to protect the eyes.

UTILITY CLEARANCES

- Elevated superstructures (e.g., drill rig, backhoe, scaffolding, ladders, cranes) shall remain a distance of 10 feet away from utility lines and 20 feet away from power lines. Distance from utility lines may be adjusted by the SSO depending on actual voltage of the lines.

- During all intrusive activities (e.g., drilling, excavating, probing), the locator line service should be contacted to mark underground lines before any work is started.

- Personnel involved in intrusive work shall determine the minimum distance from marked utilities which work can be conducted with the assistance of the locator line service.

HEAVY EQUIPMENT OPERATIONS

Working around heavy equipment can be dangerous because of the size and power of the equipment, the limited operator field of vision and the noise levels that can be produced by the equipment. Heavy equipment to be utilized at the site shall include a variety of backhoes, dozers, track loaders, and off-road trucks.

The following practices shall be followed by operators when using heavy equipment:

- Equipment should be inspected daily by the operator to ensure that the equipment is in safe operating condition.
- When not in use, hydraulic components should be left in down or "dead" position.
- Roll-over protection shall be provided on hilly sites.
- No riding on vehicles or equipment except in fixed seats.
- Seat belts should be worn at all times.
- Backup alarms, automatically activated and loud enough to be heard above background noise are required on all heavy equipment.
- Parking brakes should always be applied on parked equipment.
- Equipment should never be operated closer than 10 feet from utility lines.
- Windshields must be maintained clean and free of visual obstructions.

To ensure the safety of IT personnel in the work area, the following safety procedures regarding heavy equipment must be reviewed prior to and followed during work activities:

- Ensure that equipment operators are trained and/or experienced in the operation of the specific equipment.
- Personnel should never approach a piece of heavy equipment without the operators acknowledgment and stoppage of work or yielding to the employee.
- Never walk under the load of a bucket or stand beside an opening truck bed.
- Maintain visual contact with the operator when in close proximity to the heavy equipment.

- Wear hearing protection while on or around heavy equipment, when normal conversation cannot be heard above work operations.

- Steel-toed shoes, safety glasses, and a hard hat shall be worn for all work conducted near heavy equipment.

FACILITY/TRAFFIC

Gas station sites and other work sites with high traffic flow and limited visibility present a significant hazard to IT field staff. Since this is an area of extremely high risk, it is important that the following H&S policies and procedures are followed. While visual devices are generally effective, the use of a structural barrier (such as a company vehicle) is a more sure method of protection should a motorist fail to see an employee. Barriers shall be used on work sites when it is possible to do so without adversely affecting the project work or other client considerations. Employees are reminded to maintain a high degree of awareness of moving vehicles on the site. The following guidelines concerning traffic warning devices should be followed when working in traffic flow areas:

- Meet with the Facility Manger or Client Contact at the start of fieldwork to discuss equipment and personnel access to the work area

- Obtain any facility-related emergency information, i.e. facility alarms, evacuation areas, and special hazards

- Fluorescent orange vests shall be worn by employees when working around traffic flow areas. Ensure that there is a clear line of sight between approaching traffic and the work area.

- Orange cones, at least 28 inches high, are typically used to direct traffic flow on roadways, but are not always appropriate as a flagging device on IT project sites. Due to the low height, a cone can be easily overlooked, especially when a motorist is backing up. Cones should be stacked to at least 5-feet high with flags attached at the top to be more visible. Alternatively, a fluorescent orange post and base device with flagging at the top may be used. One option often used with cones is to place an object on the cones that will make noise if struck by a car.

- When two or more IT employees are together on a site and a site specific activity has a high risk of impact from vehicular traffic, one employee shall act as a look-out for the other employee performing the specific work activity.

NOISE

Excessive noise is hazardous not only for it's potential to damage hearing, but also it's potential to disrupt communications and instructions.

- All employees will have access to disposal ear plugs with a Noise Reduction Rating of not less than 30

- Ear plugs must be worn in any environment where workers must raise their voices to be heard while standing at a distance of three feet or less

- Ear plugs must be worn by any personnel operating concrete cutting or sawing equipment.

POWER TOOLS

- All power tools must be in good condition and free of any damage

- All power tools must be double insulated or equipped with a grounding plug. Grounding features (three-prong plugs) must not be defeated by use of adapters unless the adapter is appropriately grounded.

- All power cords and extension cords must be in good condition with undamaged insulation. Plugs and boots must also be in good condition and undamaged.

- Power tools must be unplugged whenever serviced or when not being used.

BACK INJURY PREVENTION:

LIFTING, CARRYING, PUSHING AND PULLING, SHOVELING, AND DRUM HANDLING TECHNIQUES

Back injuries on the job are costing employers in the U.S.A. approximately 6.5 billion annually. Eight out of ten people will suffer a back injury during their life time, either on or off the job. Many of these injuries could be prevented by adhering to the following proper lifting concepts:

- <u>Keep the load close to the body.</u> Arrange tasks so that the load will be close to the body and at a proper and safe height which will not require bending or stooping. Tighten stomach muscles to offset the force of the load.

- <u>Keep the load within reach.</u> Try to arrange tasks to eliminate handling loads below 20 inches or above 50 inches. Try to keep the lifting zone between your shoulders and the knuckles.

- <u>Control the load size.</u> Loads which extend beyond 16 inches in front of the body put excessive lifting stress on the body and should be handled by two people or lifting aids should be employed.

- <u>Maintain proper alignment of body.</u> The task should be designed so that twisting of the body is minimized or eliminated. Twisting while carrying a load increases injury potential significantly.

- Lift with your legs. Your leg muscles are the strongest in your body. Always bend your knees and use your leg muscles when you go toward the floor whether you have a load or not. Do not bend at your waist if it can be avoided.

- Balance your load if possible. An evenly balanced load is much easier and much safer to handle than an off balance load. Grasp the object at opposite corners if possible.

- Avoid excessive weights if possible. Mechanical aids should be used for loads which are greater than those which can be handled safely by one person.

- Lift in a comfortable manner. Workers should use a lifting position that feels comfortable for them, however, they should bend their knees and keep their back as straight as possible when performing a lift. Your feet should be shoulder width apart in order to get the best footing possible.

- Lift smoothly and gradually. Quick jerking lifting motions increase sudden and abrupt stress to the back. This type of aggressive movement can affect the discs, muscles, and the ligaments. A well controlled and smooth lifting motion will reduce the likelihood of injury.

- Most importantly, think before lifting.

In addition to these lifting techniques it is also important to implement the proper carrying techniques as follows:

- Eliminate carrying where possible. If possible, conveyors, trucks, small loaders, and other mechanical equipment should be considered. Carts and dollies should be employed when surface conditions permit. Surface conditions can be altered with plywood or other materials.

- Use two-handed carries where possible. Using a two handed carry method helps to balance the load even out the body stress.

- Keep the load close to the body. Keeping the load in close and lifting in as erect a position as possible helps to reduce the stress to the lower spine.

- Keep your arms straight. Less stress is created on the muscles and ligaments when your arms are kept straight during a carry. Contraction of the muscles will quickly increase fatigue and the possibility of an accident.

- Balance the load. A balanced load is similar to the two handed carry. The load is evenly distributed across the body and the stress is also evenly shared.

- Avoid carrying any material on stairs. Carrying on stairs will obstruct your vision and increase the likelihood of slip and fall. The bumping of the load on your leg as you climb or descend increase the chance of an injury.

- Reduce the weight if possible. When the weight of the lifts is high look for ways to reduce the weight. Use smaller containers, put less in containers, indicate fill levels, and locate lighter containers.

- Use handles. Make the task easier by adding handles where possible. If numerous repetitions are required, it may be possible to design a handled device to accommodate a two handed carrying task.

In addition to these lifting and carrying techniques it is also important to consider pushing and pulling tasks:

- Eliminate manual pushing and pulling where possible. Look at those tasks that are repeated often to see if they can be modified or altered in a way that reduces pushing and pulling. consider mechanical aids, powered conveyors, gravity slides, and chutes.

- Reduce the necessary force. Force required is a function of weight, gravity and friction. Look for opportunities to reduce these factors. Improved bearings, larger wheels, reduced weight, improved rolling surfaces, lubrication, and improved regular maintenance are all opportunities for reducing work force and stress.

- Push load instead of pulling. Studies indicate that pushing loads rather than pulling them is the safest approach. There is less stress on muscles, joints, and ligaments. As in lifting, pushing pressure should be applied firmly, but gradually. Avoid aggressive impacts.

There are also a number of guidelines to follow when addressing tasks that involve shoveling operations:

- Choose correct shovel type. The shovel should be appropriate for the material and the project. Light, loose, and fluffy materials should be handled with a scoop type shovel. A smaller shovel like a spade should be used for more dense material.

- Use a long-handled shovel. A long handled shovel should be provided to avoid stooping during shoveling activities. Take the time to obtain the correct tool for the job.

- Maintain load to 10 pounds per shovelful. The general rule of thumb for the average work situation is 10 pounds per shovel load. Work performed is a function of repetition and load. Increasing shovel loads will increase fatigue as repetitions increase and it will also increase the potential for injury.

Drum handling operations can be made safer by considering the following techniques:

- Use a drum cart where feasible. A four wheel cart is preferred for drum handling because it is more stable, better latched, and has a better handle positioning. In addition, it is more easily tipped back and held in place when the drums are loaded.

- Do not rotate from horizontal to vertical unless nearly empty. Only empty or nearly empty drums should be rotated from horizontal to vertical. A tipster or forklift with a proper drum handling attachment is the preferred method.

- Use handling equipment for moving drums from one level to another. Whenever possible pallets, scales, and conveyors should be recessed in the floor to avoid raising drums to another level. If not, drums should be handled on a low platform or an incline adapter should be provided.

- Limit drum weight to 300 pounds. Regardless of the material involved, drums should be filled to a maximum weight of 300 pounds.

- Limit travel distance to 30 feet. The other general guideline regarding drum handling involves keeping drum transport to a maximum of thirty feet.

SLIP / TRIP / HIT / FALL HAZARDS

Slip/trip/hit and fall injuries are the most frequent of all injuries to workers. They occur for a wide variety of reasons, but can be minimized by the following prudent practices:

- Spot check the work area to identify hazards.

- Establish and utilized a pathway which is most free of slip and trip hazards.

- Beware of trip hazards such as wet floors, slippery surfaces, and uneven surfaces or terrain.

- Carry loads which you can see over.

- Keep work area clean and free of clutter, especially in storage rooms and walkways.

- Communicate hazards to on-site personnel.

- Secure all loose clothing, ties, and remove jewelry while around machinery.

- Report and/or remove hazards.

- Keep a safe buffer zone between workers using equipment and tools.

HEAT STRESS

Heat-related illness can cause physical discomfort, loss of efficiency and attention to safety, and personal injury. Age, weight, degree of physical fitness, degree of acclimatization, metabolism, use of alcohol or drugs, and a variety of medical conditions such as hypertension all affect a person's sensitivity to heat. The elderly are at higher risk because of impaired cardiac output and decreased ability to sweat. Infants and young children also are susceptible to heat stress, as well. Even the type of clothing worn must be considered. Prior heat injury predisposes an individual to additional injury.

The fluid loss and dehydration resulting from physical activity puts outdoors laborers at particular risk. Certain medications predispose individuals to heat stress, such as drugs that alter sweat production (antihistamines, anti-psychotics, antidepressants) or interfere with the body's ability to regulate temperature. Persons with heart or circulatory diseases or those who are on "low salt" diets should consult with their physicians prior to working in hot environments.

It is difficult to predict just who will be affected and when, because individual susceptibility varies. In addition, environmental factors include more than the ambient air temperature. Radiant heat, air movement, conduction, and relative humidity all affect an individual's response to heat.

HEAT RELATED ILLNESSES

Heat rash, also known as prickly heat, may occur in hot and humid environments where sweat is not easily removed from the surface of the skin by evaporation. It can normally be prevented by resting in a cool place and allowing the skin to dry.

Fainting (heat synope) may be a problem for the worker unacclimatized to a hot environment who simply stands still in the heat. Victims usually recover quickly after a brief period of lying down. Moving around, rather than standing still, will usually reduce the possibility of fainting.

Heat cramps, painful spasms of the muscles, are caused when workers drink large quantities of water but fail to replace their bodies' salt loss. Tired muscles, those used for performing the work, are usually the ones most susceptible to cramps. Cramps may occur during or after working hours and may be relieved by taking liquids by mouth or saline solutions intravenously for quicker relief, if medically determined to be required.

Heat exhaustion results from loss of fluid through sweating when a worker has failed to drink enough fluids or take in enough salt or both. The worker with heat exhaustion still sweats but experiences extreme weakness or fatigue, giddiness, nausea, or headache. The skin is clammy and moist, the complexion pale or flushed, and the body temperature is normal or slightly higher. Treatment is usually simple: the victim should rest in a cool place and drink an electrolyte solution (a beverage used by athletes to quickly restore potassium, calcium, and magnesium salts) such as Gatorade®. Severe cases involving victims who vomit or lose consciousness may require longer treatment under medical supervision.

Heat stroke, the most serious health problem for workers in hot environments, is caused by the failure of the body's internal mechanism to regulate its core temperature. Sweating stops and the body can no longer rid itself of excess heat. Signs include mental confusion, delirium, loss of consciousness, convulsions or coma; a body temperature of 106 degrees F or higher; and hot dry skin which may be red, mottled, or bluish. Victims of heat stroke will die unless treated promptly. While awaiting medical help, the victim must be removed to a cool area and his or her clothing soaked with cool water. He or she should be fanned vigorously to increase cooling. Prompt first aid can prevent permanent injury to the brain and other vital organs.

PROTECTION AND CONTROLS

OSHA does not have a specific regulation for heat stress. But because heat stress is known as a serious hazard, workers are protected under the General Duty Clause of the Occupational Safety and Health Act. The clause says employers must provide "employment free from recognized hazards causing or likely to cause physical harm."

The following procedures are preventative measures to reduce heat stress:

- **Drink a lot of cool water all day - before you feel thirsty.** Every 15 or 20 minutes, you should drink a cup of water, Gatorade, or equivalent (5 to 7 ounces). These liquids should contain electrolytes to help replace those lost during sweating. Most workers exposed to hot conditions drink less fluids than needed because of an insufficient thirst drive. A worker, therefore, should not depend on thirst to signal when and how much to drink. If you drink only when you are thirsty you are dehydrated already. Caffeinated fluids should be minimized as they can lead to dehydration.

- **Take rest breaks.** Establish work and rest regimes. Rest in a cool, shady spot. Use fans. Provide a supply of salty foods that can be eaten during rest periods. Supervisors should be aware of the early signs of heat stress and should permit workers to interrupt their work if they are extremely uncomfortable.

- **Conduct monitoring for heat stress.** This can be accomplished by using a Wet Bulb Global Temperature (WBGT) meter. The WBGT is a weighted average of the wet bulb, dry bulb, and global temperature which is supposed to simulate the temperature stresses experienced by people. The wet bulb (WB) temperature is measured by exposing a wet sensor, such as a wet cotton wick fitted over the bulb of a thermometer, to the effects of evaporation and convection. The dry bulb (DB) temperature is measured with an ordinary mercury-in-glass thermometer, that is shielded from direct radiant energy sources. The globe temperature (GT) is the temperature inside a blackened, hollow, thin copper globe, which takes into account the radiant heat from the sun. WBGT values are calculated by the following equations:

Outdoors with solar load: WBGT = 0.7 WB + 0.2 GT + 0.1 DB

Indoors or outdoors with no solar load: WBGT = 0.7 WB + 0.3 GT

- **Do the heaviest work in the coolest time of the day.**

- **Work in the shade.** Use a beach umbrella or string a tarp from your vehicle.

- **Ice vests.** Vests, coats and bandannas containing ice packs are commercially available which help to minimize heat stress. These may be necessary especially if working in protective clothing such as Tyvek or Saranex suits which prevent heat from the body to escape.

- **Maintain shower sprinkler on site.** If water and sprinkler facilities are available this is a good method for quickly cooling down workers on a regular basis.

- **For heavy work in hot areas,** take turns with other workers, so some can rest.

- **If you travel to a warm area for a new job,** you need time for your body to get used to the heat. Acclimatization to the heat through short exposures followed by longer periods of work in the hot environment can reduce heat stress. New employees and workers returning from an absence of two weeks or more should have a 5-day period of acclimatization. This period should begin with 50 percent of the normal workload and time exposure the first day and gradually building up to 100 percent on the fifth day.

- **If you work in protective clothing,** you need more rest breaks. You may also need to check your temperature and heart rate. When semipermeable or impermeable clothing is being used and the temperature is 70 degrees F or more, the EPA says that a health professional should be present to monitor worker's body weight, temperature, and heart rate.

- **A buddy system** should be implemented during field activities involving work in hot environments, especially while wearing Level C and B protective clothing. The buddy shall be able to provide his or her partner with assistance, observe his or her partner for signs of heat stress disorders, aid in the treatment of heat stress should the need occur, and notify emergency personnel if emergency help is needed.

- **If you think someone has heat stroke, call 911.** Move the person to the shade, wipe his/her skin with cool water, and loosen his/her clothes. Use a piece of cardboard or other material to fan them.

WORK AND REST REGIMES TO PREVENT HEAT STRESS

Work and rest regimes are designed to aid in the prevention of heat stress. The following table shows the work and rest regimes for D, C, and B levels of protection, according to the WBGT, acclimatization and the use of personal protective equipment (PPE). Non-acclimatized personnel should begin with 50 percent of the normal workload and time exposure the first day and gradually build up to 100 percent over a five day period. The specific ranges for the work and rest regime should be determined by the site supervisor or site safety officer based on environmental conditions encountered, difficulty of the work being performed, and the health and fitness of the worker's involved.

Work/Rest Regime for Heat Stress

WBGT (Acclimatized workers)	**Work and Rest Regime/hour (percent) Level D**	**Work/Rest Regime/hour (percent) Level C[a]**	**Work/Rest Regime/hour (percent) Level B[b]**
77 °F	Continuous	Continuous	75/25 or Continuous
84 °F	Continuous	75/25 or Continuous	50/50 or 75/25
88 °F	75/25 or Continuous	50/50 or 75/25	25/75 or 50/50
90 °F[c]	50/50 or 75/25	25/75 or 50/50	No work or 25/75
94 °F[d]	25/75 or 50/50	No Work or 25/75	No Work
98 °F[e]	No Work or 25/75	No Work	No Work

NOTE: WBGT = wet bulb globe temperature.
[a] Used also for all Level B work using Saranex/Tyvek suits and ice vests.
[b] Used also for all Level B work using Saranex/Tyvek suits, no ice vests.
[c] No Level B work conducted in temperatures above 90 °F.
[d] No Level C work conducted in temperatures above 94 °F.
[e] No Level D work conducted in temperatures above 98 °F.

COLD RELATED ILLNESSES

Cold temperatures can also pose health hazards to site workers. Exposure to cold is classified into two categories: local or general. Local injuries include frostnip, frostbite, chilblain and trenchfoot. General injuries include hypothermia and blood vessel abnormalities (genetically or chemically induced). Major factors contributing to cold injury are exposure to humidity and high winds, contact with wetness or metal, inadequate clothing, age and general health. Allergies, vascular disease, excessive smoking or drinking, and certain drugs and medicines are physical conditions that can compound the effects of exposure to a cold environment. A cold stress guidelines table is included at the end of this section for quick reference.

SIGNS AND SYMPTOMS

Hypothermia. Hypothermia is a condition of reduced body temperature. Most cases develop in air temperatures between 30-50^0 F, not taking wind-chill factor into consideration. Symptoms of hypothermia include personality changes, reduced mental alertness, irrationality, and uncontrollable shivering. The heartbeat slows and sometimes becomes irregular, weakening the pulse and changing blood pressure. Changes in the body chemistry cause severe shaking or rigid muscles, vague or slow speech, memory lapses, incoherence, and drowsiness. Cool skin, slow irregular breathing, low blood pressure, apparent exhaustion, and fatigue after rest may precede complete collapse.

As the core body temperature drops, the victim can become listless, confused, and make little or no effort to keep warm. Pain in the extremities can be the first warning of dangerous exposures to cold. At a core body temperature of about 85^0 F, serious problems develop due to significant drops in blood pressure, pulse rate and respiration.

Sedative drugs and alcohol increase the risk of hypothermia. Sedative drugs interfere with the transmission of impulses to the brain. Alcohol dilates blood vessels near the skin's surface, increasing heat loss and lowering body temperature.

First aid treatment includes removal of the victim to a warm and dry location, removal of cold and damp clothing, wrapping the victim in warm blankets or clothing, and rewarming the victim from the core, not from the extremities. Severe hypothermia must be treated by a medical professional

Symptoms of frostbite include numbness and whitening of the skin. First aid treatment includes warming with blankets, warm compresses, or lukewarm water. Severe frostbite must be treated by a medical professional.

Raynaud's Phenomenon. Raynaud's Phenomenon is the abnormal constriction of the blood vessels of the finger on exposure to cold temperatures, resulting in blanching of the fingertips. Numbness, itching, tingling, or a burning sensation may occur during related attacks. The disease is also associated with the use of vibrating hand tools in a condition sometimes called White Finger Disease. Persistent cold sensitivity, ulceration, and amputations can occur in severe cases.

Frostnip occurs when the face or extremities are exposed to a cold wind, causing the skin to turn white.

Frostbite is the freezing of the body tissues due to exposure to extremely low temperatures, resulting in damage to and loss of tissue. Frostbite occurs because of inadequate circulation or insulation, resulting in freezing of fluids around the cells of the body tissues. Most vulnerable parts of the body are the nose, cheeks, ears, fingers, and toes.

Frostbite can affect outer layers of skin or can include the tissues beneath. Damage can be serious, with permanent loss of movement in the affected parts, scarring, necrotic tissue, and amputation resulting. Skin and nails that slough off may grow back.

The freezing point of the skin is about 30^0 F. As wind velocity increases, heat loss is greater and frostbite will set in more rapidly.

There are three degrees of frostbite. First degree is freezing without blistering and peeling; second degree is freezing with blistering and peeling; and third degree is freezing with death of skin tissues and possibly the deeper tissues.

The following are symptoms of frostbite:

- Skin changes color to white or grayish-yellow, progresses to reddish-violet, and finally turns black as the tissue dies.
- Pain may be felt at first, but subsides.
- Blisters may appear.
- Affected part is cold and numb.

The first symptom of frostbite is usually an uncomfortable sensation of coldness, followed by numbness. Tingling, stinging, cramping and aching feelings will follow. Frostbite of the outer layer of the skin has a waxy or whitish look and is firm to the touch. Cases of deep frostbite cause severe injury. The victim is often unaware of the frostbite until someone else observes these symptoms. It is therefore important to use the "buddy system" when working in cold environments, so that symptoms of overexposure can be monitored.

Wind chill, or the cooling effect of moving air, is of critical importance when evaluating the cold exposure of site workers. The potential for frostbite and hypothermia increases greatly with combined cold temperatures and high wind speeds. Workers should inform the site supervisor, or site safety officer, if their hands, face, or feet feel numb, and workers should monitor each other for patches of pale or white skin on the face and ears.

The following table describes the cooling power of wind on exposed flesh. This information can be used as a guide for determining equivalent chill temperatures when the wind is present in cold environments.

Cooling Power of Wind on Exposed Flesh Expressed as an Equivalent Temperature*

Estimated Wind Speed (in mph)	Actual Temperature Reading (°F)											
	50	40	30	20	10	0	-10	-20	-30	-40	-50	-60
	Equivalent Chill Temperature (°F)											
Calm	50	40	30	20	10	0	-10	-20	-30	-40	-50	-60
5	48	37	27	16	6	-5	-15	-26	-36	-47	-57	-68
10	40	28	16	4	-9	-24	-33	-46	-58	-70	-83	-95
15	36	22	9	-5	-18	-32	-45	-58	-72	-85	-99	-112
20	32	18	4	-10	-25	-39	-53	-67	-82	-96	-110	-121
25	30	16	0	-15	-29	-44	-59	-74	-82	-104	-118	-133
30	28	13	-2	-18	-33	-48	-63	-79	-94	-109	-129	-140
35	27	11	-4	-20	-35	-51	-67	-82	-98	-113	-129	-145
40	26	10	-6	-21	-37	-53	-69	-85	-100	-116	-132	-148
(Wind speeds greater than 40 mph have little additional effect)	**LITTLE DANGER** In less than an hour with dry skin. Maximum danger of false sense of security.				**INCREASING DANGER** Danger from freezing of exposed flesh within one minute.			**GREAT DANGER** Flesh may freeze within 30 seconds.				
	Trench foot may occur at any point on this chart.											

* Developed by U.S. Army Research Institute of Environmental Medicine, Natick, MA.

Trench Foot and Chilblains. Trench foot is swelling of the foot caused by long continuous exposure to cold without freezing, combined with persistent dampness or immersion in water. Edema (swelling), tingling, itching and severe pain occurs, followed by blistering, necrotic tissue and ulcerations. Chilblains have similar symptoms as trench foot, except that other areas of the body are affected.

TREATMENT

Remove the patient to a warm, dry place. If clothing is wet, remove and replace with dry clothing. Keep patient warm. Rewarming of patient should be gradual to avoid stroke symptoms. Patient dehydration may result in cold injury due to a significant change in blood flow to the extremities. If patient is conscious and alert, warm, sweet liquids should be provided. Coffee and other caffeinated liquids should be avoided because of diuretic and circulatory effects. Extremities affected by frostbite should be gradually warmed up and returned to normal temperature. Moist compresses should be applied; begin with lukewarm compresses and slowly increase the temperature as changes in skin temperature are detected. Keep patient warm and calm. Remove to a medical facility as soon as possible.

PREVENTION AND CONTROLS

The reduction of adverse health effects from cold exposure is achieved by adopting the following work practices:

- Providing adequate dry insulating clothing to maintain core temperature above 98.6 ^{0}F to workers if work is performed in air temperature below 40 ^{0}F. Wind chill cooling rates and the cooling power of air are critical factors. The higher the wind speed and the lower the temperature in the work area, the greater the insulation value of the protective clothing required.

- If the air temperature is of 32 ^{0}F or less, hands should be protected by gloves or mittens.

- If only light work is involved and the worker's clothing becomes wet on the job site, the outer layer of clothing should be impermeable to water. With more severe work under such conditions, the outer layer should be water repellent, and the outer wear should be changed as it becomes wet. The outer garments should include provisions for easy ventilation in order to prevent wetting of the inner layer of sweat.

- If available clothing does not give adequate protection to prevent cold injury, work should be modified or suspended until adequate clothing is made available, or until weather conditions improve.

- Use heated warming shelters available nearby (e.g., on-site trailer) at regular intervals, the frequency depending on the severity of the environmental exposure. When entering the heated shelter, remove the outer layer of clothing and loosen the remainder of clothing to permit heat evaporation or change to dry work clothing.

- Provide warm sweet drinks (e.g., hot chocolate) and soups at the work site for calorie intake and fluid volume. Limit the intake of coffee because of the diuretic and circulatory effect.

- Include the weight and bulk of clothing in estimating the required work performance and weights to be lifted by the worker.

- Implement a buddy system in which workers are responsible for observing fellow workers for early signs and symptoms of cold stress.

- Unacclimatized employees should not work full-time in cold until they become accustomed to the working conditions and required protective clothing.

- Observe work and warming regimen as shown in the following table.

The following table shows the recommended number of breaks that should be taken per hour based upon the air temperature and wind speeds encountered. This table also lists the maximum sustained work period (in minutes) allowed when working under these conditions.

Work/Warming Regimen

Air Temperature - Sunny Sky		No Noticeable Wind		5 mph Wind		10 mph Wind		15 mph Wind		20 mph Wind	
^{0}C (approx.)	^{0}F (approx.)	Max Work Period	# of breaks	Max Work Period	# of breaks	Max Work Period	# of breaks	Max Work Period	# of breaks	Max Work Period	# of breaks
-26 to -28	-15 to -19	(Norm Breaks) 1		(Norm Breaks) 1		75 min.	2	55 min.	3	40 min.	4
-29 to -31	-20 to -24	(Norm Breaks) 1		75 min.	2	55 min.	3	40 min.	4	30 min.	5
-32 to -34	-25 to -29	75 min.	2	55 min.	3	40 min.	4	30 min.	5	non-emergency work should cease	
-35 to -37	-30 to -34	55 min.	3	40 min.	4	30 min.	5	non-emergency work should cease		non-emergency work should cease	
-38 to -39	-35 to -39	40 min.	4	30 min.	5	non-emergency work should cease		non-emergency work should cease		non-emergency work should cease	
-40 to -42	-40 to -44	30 min.	5	non-emergency work should cease		non-emergency work should cease		non-emergency work should cease		non-emergency work should cease	
-43 and below	-45 and below	non-emergency work should cease		non-emergency work should cease		non-emergency work should cease		non-emergency work should cease		non-emergency work should cease	

Appendix D – RI Proposal

With the following exceptions, the RI proposal included in this appendix has not been modified from the original version submitted to the DEQ on June 22, 2000.

- Figure 10, the conceptual site model (CSM) was revised to include potential food chain exposure routes (i.e., fish consumption) as suggested by the DEQ (2000c).
- Figures 1, 2, and 3 are not included because they are re-issued and renumbered in the RI workplan as Figures 2-1, 2-2, and 2-3, respectively.
- Figure 13 (sheets 1 to 11), the water quality trend plots, are included in Appendix F of the workplan.

MCCALL OIL & CHEMICAL CORPORATION
REMEDIAL INVESTIGATION PROPOSAL

PORTLAND, OREGON

Prepared for

McCall Oil & Chemical Corporation

June 2000

Prepared by

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Project 807595 Task 01000000

McCall Oil & Chemical Corporation
Remedial Investigation Proposal
Portland, Oregon

The material and data in this report were prepared under the supervision and direction of the undersigned.

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John Edwards, RG, CEG
Senior Consultant

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Low Molecular Weight PAH	LPAH
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Underground Storage Tank	UST
Volatile Organic Compound	VOC

1 INTRODUCTION

1.1 Purpose

On May 8, 2000, McCall Oil & Chemical Corporation (MOCC) entered into a Voluntary Agreement For Remedial Investigation and Source Control Measures (the Agreement). The Agreement requires MOCC to conduct a Remedial Investigation that satisfies the requirements of OAR 340-122-0080, and develop, a DEQ approved workplan. Section III of attachment B of the Agreement requires that a Remedial Investigation Proposal be submitted to DEQ within 30 days of signature of the Agreement, June 8, 2000.

The intent of this Remedial Investigation (RI) Proposal is to provide the framework for the RI Work Plan. This RI Proposal meets the requirements of the Agreement.

Much of the background and facility operational information in this RI Proposal is derived from the April 5, 1994 Preliminary Assessment of McCall Oil & Chemical Revere Corporation (MOCC) and Great Western Chemical Company(GWCC), ESCI ID # 134. The facility operation information from the preliminary assessment has been updated to reflect the changes that have taken place in the intervening six years. The information sources used in preparing this RI Proposal are listed on Table 1.

1.2 Property Description

The site is located in the industrialized area of northwest Portland along NW Front Avenue (see Figure 1). It occupies approximately 36 acres on the southwest bank of the Willamette River. The site encompasses six tax lots. GWC Properties, Inc., a subsidiary of MOCC, owns tax lot 17. MOCC owns tax lot 96. The Port of Portland (Port) owns lots 15, 24, 26, and 27. GWCC occupies tax lot 17; MOCC occupies tax lots 15, 24, 26, and 96 (see Figure 2). Before 1966, most of the land now included in lots 15, 24, and 26 was submerged beneath the Willamette River. The Port created new land along the Willamette during the mid-1960s by dredging and filling along the shore. This land, including a portion of the subject site, was deeded to the Port by the state of Oregon in 1967.

The property is currently occupied by two separate facilities: MOCC, which operates a marine terminal and asphalt facility, and GWCC, which operates a chemical distribution facility (see Figure 3). Until 1995, the GWCC facilities consisted of two operating units, the GWCC Technical Center and the GWCC Portland Branch. The Technical Center included the former Chemax operations. In 1995, GWCCs two operating units were merged into the Portland Branch. Current and historical activities associated with the operations of each of these facilities are discussed in detail in chapters two through five.

1.3 Surrounding Land Use

The site is included in the Willamette Greenway (Greenway) established by the City of Portland to monitor and control land use next to the river. The site and surrounding properties are zoned for heavy industrial use, both within the Greenway on the left bank (facing downriver) and outside of the Greenway (Figure 4). Surrounding industries include: petroleum bulk distribution terminals, chemical plants, sand and gravel operations, a steel fabrication facility, shipyards, and rail yards

1.4 General Site History

In the mid-1920s the Port purchased the property now occupied by MOCC and GWCC as part of an approximately 65-acre parcel that stretched from the lands owned by Union Oil Company of California (Unocal) on the west, to the Willamette River. Prior to the mid-1940s the property was vacant. In 1946, Pioneer Flintkote Company (Flintkote) purchased two parcels from the Port, corresponding generally to present site tax lots 17 and 96 (see Figure 2). These tax lots are currently occupied by GWCC and the MOCC asphalt plant, respectively.

Flintkote manufactured asphalt roofing shingles and tiles on the property from 1947 to approximately 1982. A factory, a warehouse for roofing material, silos, boilers, aboveground and underground storage tanks (ASTs and USTs, respectively), and retorts were situated on tax lot 17. Historical occupation records indicate that Standard Oil Company operated a distribution center at the address corresponding to adjacent tax lot 96 during the 1950s (SAFE, 1994). By 1960, Douglas Oil Company (Douglas) occupied this address, and operated an asphalt facility. In 1962, Douglas purchased tax lot 96 from Flintkote. Douglas and Flintkote continued to operate their respective facilities until 1982, when both parcels and the improvements were sold to MOCC. Erro Enterprises (Erro), a McCall family subsidiary purchased the asphalt facility from MOCC in 1982 and operated the facility until 1992, when it was sold back to MOCC. GWC Properties, Inc., now owns tax lot 17.

Chemax began operations on the former Flintkote site in early 1984. The Portland branch began its on-site operations in late 1985. In 1985, MOCC operated a lube oil distribution facility on part of the asphalt plant site. The lube oil operations were discontinued in 1991.

In the early to mid-1960s, the Port used dredge spoils from the Willamette River channel (primarily fine sand) to create new land along the Willamette River next to the Flintkote and Douglas facilities. As stated previously, this land was subsequently deeded to the Port by the state of Oregon in 1967. In the mid-1970s, MOCC constructed the marine terminal on the filled land (corresponding approximately to tax lots 15, 24, 26 and 27; see Figure 2).

2 MCCALL OIL AND CHEMICAL CORP BACKGROUND

2.1 Site Description

MOCC and GWCC are separate and independent businesses occupying the site under the ownership of the McCall family. Because the two businesses have distinctly different product lines and operate under separate environmental permits they are described separately in chapters two through five.

Operations at MOCC include a marine terminal and an asphalt plant (see Figure 5). The MOCC employees interviewed during preparation of this RI Proposal are listed on Table 2. The facility stores, blends, and distributes petroleum products including asphalt, bunker fuel, and diesel fuel. Bulk petroleum products are stored in ASTs at the marine terminal tank farm and at the asphalt plant. AST capacities and contents are summarized in Table 4.

The marine terminal has operated since 1975 and includes the marine dock, ASTs, the truck loading rack, an equipment maintenance storage shed, and offices. MOCC has operated the asphalt plant since 1982. The asphalt plant includes ASTs, railcar and truck loading racks, boilers, and a product testing laboratory

2.2 Ownership and Operational History

2.2.1 Ownership History

Flintkote purchased the property now occupied by the asphalt plant from the Port of Portland in 1946. In 1962, Douglas purchased the property from Flintkote. MOCC purchased the property in 1982; the property was sold to Erro the same year. Erro sold the property back to MOCC in 1992. The MOCC ownership and operational history are summarized on Table 3.

The Port owns the land currently occupied by the marine terminal. As stated previously, this land was created by filling with dredge spoils along the Willamette River during the mid-1960s. The filled land was deeded to the Port by the State of Oregon in 1967 (see Table 3).

2.2.2 Operational History

Marine Terminal The MOCC marine terminal and the asphalt plant are discrete operational areas. MOCC constructed the marine terminal in 1974 and began on-site operations in 1975. Initially, the facility was used as a common terminal for MOCC, Crown Zellerbach, and Boise Cascade. Since the beginning, the marine terminal operations included:

- Receiving petroleum products at the marine dock
- Receiving petroleum product via the Olympic pipeline
- Storing petroleum products at the marine terminal tank farm
- Distributing (i.e., dispensing) petroleum products at the marine dock and the truck loading rack
- Transferring petroleum products from the marine terminal to the asphalt plant

The MOCC map of impervious areas and stormwater routing is on Figure 6. Stormwater collected in the tank farm, runoff from the parking lot, and material collected in sumps on the dock and in the loading area is directed to an API oil-water separator. Three new bays were added to the oil water separator in 1996, increasing the treatment capacity to 675 gallons per minute sludge in the separator is removed to a tank. Water from the tank is discharged, via the oil-water separator, to the river according to NPDES permit requirements.

Asphalt Plant. The asphalt plant has been on the site since the 1950s. The facility has been operated by Standard Oil Company (mid-to late- 1950s), Douglas (late 1950s to 1982), and MOCC (1992 to present). The facility historically received, stored, blended, and distributed roofing grade and paving grade asphalt. Based upon available information provided by current and former site personnel, historical operations conducted at the asphalt plant included:

- Receiving and storing asphalt products
- Blending asphalt to customer specifications
- Operating boilers to heat asphalt storage tanks
- Distributing and dispensing products at the truck rack
- Receiving products by railcar
- Operating a product testing laboratory

- Receiving petroleum product via the Chevron subgrade pipeline

- Receiving petroleum product at the marine dock

The asphalt plant received product from the Chevron facility southwest of the site via a subgrade 6-inch pipeline, which was installed beneath Front Avenue in 1957 and replaced in 1991. The pipeline, which was used exclusively for asphalt products, passed periodic hydrotesting and has had no known ruptures. The pipeline was replaced in 1991 with a 6-inch product line inside 14-inch secondary containment piping. Douglas operations included product modification operations (i.e., blending, air-blowing) to meet customer (e.g., Flintkote) specifications. Asphalt was stored in aboveground 10,000 barrel (bbl) storage tanks (tank numbers 19, 20, and 21) (see Figure 5) along with other ancillary smaller capacity ASTs Douglas manufactured medium cure products containing kerosene distillates, rapid cure products containing petroleum naphthalene, and stove oil. A small product testing laboratory conducted primarily penetration testing on asphalt samples.

Douglas also operated a marine dock at the northeastern portion of the site along the Willamette River. The marine dock received asphalt by barge via a pipeline connecting the dock to the asphalt facility. The original dock was replaced with the existing dock which is located directly northeast of the marine terminal. Erro operated a lubrication (lube) oil distribution facility at the asphalt plant from 1982 until approximately 1991. Lube oil was stored in ASTs from the former Douglas facility.

2.2.3 Permits

The MOCC marine terminal operates consistent with NPDES permit no. 1300-J for stormwater run off to the Willamette River; NPDES permit no. 500-J for boiler blowdown discharge to the Willamette River; and air contaminant discharge permit no. 26-2596 for fuel burning equipment such as boilers.

2.2.4 Waste Handling Practices

Solid-phase waste generated at MOCC includes oil-water separator solids, tank bottom solids, and oil-absorbent booms and pads. Liquid-phase waste includes rinsate from tank cleaning activities, slop tank water, slop tank oil and grease, oil from the oil-water separator, and waste solvents from equipment cleaning at the materials testing laboratory.

Oil-water separator solids are routinely pumped and sent off-site to a permitted Resource Conservation and Recovery Act (RCRA) treatment, storage, and disposal (TSD) facility. Tank bottom solids are collected in 55-gallon drums or in roll-off boxes and disposed of off-site at a permitted RCRA TSD facility. No tank bottom solids are disposed on site. Oil-absorbent booms and pads used in spill cleanup operations are placed in 55-gallon metal drums and also disposed of at a permitted RCRA TSD facility. Liquid-phase waste, including rinsate from tank cleaning activities and slop tank water, are directed to the oil-water separator. Effluent from the oil-water separator and stormwater are tested weekly for pH and oil and grease content and discharged to the Willamette River in accordance with the requirements of NPDES permit no. 1300-J. Slop tank oil and oil from the oil-water separator are pumped and sent offsite to a fuels blending facility for reprocessing. Solvent use is restricted to parts cleaning stations at the materials testing laboratory. The parts cleaning stations are maintained by Safety Kleen and waste solvents are periodically transported via Uniform Hazardous Waste Manifest and disposed of offsite by Safety Kleen at a permitted RCRA TSD facility.

2.2.5 Underground Storage Tanks

Records provided by MOCC indicate that three underground storage tanks (USTs) formerly existed at the MOCC marine terminal site.

A 20,000-gallon ethanol UST and a 4,000-gallon emergency containment UST were removed in 1989 (SAFE, 1994). These tanks were installed in 1979. The tanks were undamaged when removed. No evidence of adverse environmental impact was noted during the removal activities. DEQ records indicate that the 20,000-gallon tank may also have been used to store diesel fuel. A soil sample collected from beneath the 20,000-gallon tank contained 29 parts per million (ppm) total petroleum hydrocarbon (TPH); a soil sample from beneath the 4,000-gallon tank contained 12 ppm TPH. These concentrations were below the DEQ's level 1 soil cleanup concentration of 40 ppm determined by using the DEQ soil cleanup level decision matrix (see OAR 340-122-205 through 340-122-360). Therefore, pursuant to the DEQ regulations, no further action is required.

A 250-gallon heating oil UST next to the marine terminal office building was emptied in 1990. The tank had been used to store heating oil for office space heating, but its use was discontinued when MOCC installed a natural gas furnace. The tank remains in place.

2.3 Site Investigation and Regulatory Inspection History

2.3.1 Environmental Risk Assessment

In 1985, MOCC commissioned an environmental risk assessment of the marine terminal as a requirement for obtaining liability insurance. Risk Science International (RSI) evaluated facility operations and prepared a report, which concluded that the risk of environmental impairment from operations at the terminal was moderate, primarily because of the potential for spills or leaks of materials flowing directly into the Willamette River (RSI, 1985).

2.3.2 DEQ Inspections

In September 1982, the DEQ collected samples of ponded rinsate at the MOCC asphalt plant tank farm after tank cleaning activities. DEQ records indicate that MOCC was assessed a $500 civil penalty for improper handling of the rinsate. Available records also indicate that the DEQ conducted routine inspections under air contaminant discharge permit no. 26-2596 for boiler operation.

3 MCCALL OIL AND CHEMICAL CORP WASTE CHARACTERISTICS

3.1 Potential Sources of Hazardous Substances

3.1.1 Products Stored at the Facility

Hazardous materials currently stored in the ASTs at MOCC include the following:

Marine Terminal

- Asphalt
- Diesel fuel
- Marine diesel oil
- Bunker fuel

Petroleum naphthalene and PS-300 were also historically stored in tanks at the marine terminal.

Asphalt Plant

- Asphalt flux (blending agent)
- Paving-grade asphalt
- Petroleum naphthalene
- PS-300 (80 percent black oil; 20 percent diesel fuel)
- Emulsion-based asphalt
- Latex

These products are stored in ASTs located within the bermed marine terminal tank farm and the asphalt plant tank farm (see Table 4 and Figure 5). The marine terminal is surrounded by an earthen dike coated with emulsified asphalt. The asphalt plant storage tanks are contained within a 4-foot high concrete structure.

Small quantities of vehicle antifreeze, lubrication oils, citric acid based cleaner, greases, and solvents are stored at the materials testing laboratory's bermed storage area at the asphalt plant and inside the equipment maintenance shed at the marine terminal. Solvent usage is limited to the materials testing laboratory. As stated previously, these solvents are used at self contained parts cleaning units supplied and maintained by Safety Kleen.

Hazardous materials formerly used at MOCC to clean laboratory equipment and the product loading racks include the following:

- Solvents (e.g., benzene and trichloroethylene)
- Degreasers (e.g., kerosene)
- Chemax 528 (no MSDS available)
- Chevron asphalt remover (no MSDS available)

Solvents, such as benzene and trichloroethylene, and degreasers were used at the asphalt plant to clean laboratory testing equipment and tools. Chemax 528 and Chevron asphalt remover were used to clean the truck loading racks at the marine terminal and asphalt plant. Cleaning was conducted over secondary containment structures and there were no known releases of the products. The use of these materials was gradually phased-out between 1978 and 1985.

3.1.2 Wastes Generated and Managed at the Site

Solid-phase waste generated at MOCC includes oil-water separator sludges, tank bottom sludges and solids, and oil-absorbent booms and pads. Liquid-phase wastes include rinsate from tank cleaning activities, slop tank oil and grease, slop tank water, effluent from the oil-water separator, stormwater runoff, and waste solvents used for cleaning equipment at the materials testing laboratory.

Before 1975, waste asphalt and construction debris were reportedly disposed of in the western portion of the site. This practice was discontinued after 1975. Currently, solid waste generated at the facility is transported off-site for disposal consistent with applicable solid waste disposal requirements. Solvents are transported off-site as hazardous waste for disposal at a permitted RCRA TSD facility. Rinsate is typically not generated during tank cleaning operations; however, if rinsate is generated, it is pumped out of the tank and recycled off-site at a fuels blending facility.

3.1.3 Potential Sources Identified From Site Investigations

While releases have occurred during the MOCC facilities operation history, these have primarily consisted of asphalt or heavy oil materials and have been cleaned up immediately following the release. In addition, these materials are solid or semi-solid at ambient temperatures and, therefore, migration is expected to be very limited. The viscosity and other physical properties of the petroleum products stored at MOCC are listed on Table 6. Because most of these materials are not liquid at a temperature of 60° F and atmospheric pressure of 14.7 pounds per square inch (psi), they are not hazardous substances under the Oregon Superfund laws (see ORS 465.200 through 465.455) and do not meet the definition of oil under ORS 465.200(11). A summary of historical spill releases is provided on table 5. The MOCC Oil Historical Release Locations are shown on Figure 7.

3.2 Waste Characteristics Conclusions

Solid and hazardous waste generated by the MOCC operations are properly handled. Because of the physical/chemical characteristics (e.g., viscosity) of the materials historically stored at the MOCC site (e.g., asphalt and black oil), spills of products in the asphalt plant and the marine terminal tanks farm areas would not be expected to migrate to depth in soil or dissolve readily in water. Also, the spills have been responded to and cleaned up immediately. The possibility of surface runoff contacting MOCCs products is minimized because the majority of the products are stored in closed tanks. Further, site engineering controls (e.g., secondary containment berms, and emergency shut-off valves) and the requirements of the facility's NPDES permits limit the possibility that surface runoff potentially impacted by these products will be released to the environment. Consequently, there are not expected to be adverse impacts to human health or the environment associated with releases of asphalt and heavy oil products to soil in the asphalt plant and marine terminal tank farm areas.

4 GREAT WESTERN CHEMICAL COMPANY BACKGROUND

4.1 Site Description

At the time of the 1994 preliminary assessment GWCC facilities on the subject site were divided into two distinct operating entities, the Technical Center (formerly known as Chemax) and the Portland Branch. In 1995, the two facilities were combined and merged into the Portland Branch. The northern portion of the GWCC facility (formerly known as the Technical Center) produces water treatment chemicals, industrial cleaning agents and sanitizers, and other products. The southern portion of the GWCC facility (formerly distinct as the Portland Branch) receives, stores, and repackages chemicals, as well as, distributes gaseous, liquid, and dry chemicals. GWCC has been operating on the site since early 1984. The ownership and occupational history of the Great Western Chemical Corporation facilities is summarized on table 7.

The site is bounded on the southwest by NW Front Avenue, on the southeast by the MOCC asphalt plant, on the northeast by a vacant strip of Port property and the MOCC marine terminal, and on the northwest by land leased to Union Oil of California (Unocal) for a pipeline and distribution dock.

Chevron, Unocal, and Shell operate bulk petroleum distribution facilities across NW Front Avenue near the GWCC site. The Tube Forgings of America facility borders the MOCC marine terminal and asphalt plant on the southeast.

The locations of the GWCC operations are shown on Figure 8. In the northern portion of the main warehouse, products are mixed in designated liquid and dry mixing areas on two levels inside the warehouse. Bulk chemicals used in production are stored in approximately a dozen outside ASTs located behind the warehouse, and in steel or polypropylene drums and totes located both inside and outside the warehouse. A current list of ASTs, their capacity and contents is on Table 8A. Chemicals packed in cardboard drums, paper bags, and plastic bags are stored on pallets inside the warehouse. Outside storage tanks are set on elevated concrete pads and are surrounded by concrete containment berms. Drums are stored on pallets over concrete floors (inside) or asphalt paving (outside). Totes are stacked on asphalt surfaces. There is a small maintenance shop on the north side of the warehouse. Polymers received by rail are pumped through overhead piping and hoses from the railcar loading area in the front of the facility to the storage tanks behind the warehouse.

The southeastern half of the warehouse, comprising an area of approximately 35,000 square feet, is reserved for storage of food-grade chemicals and oxidizers. Two adjacent tank farms for bulk storage of solvents and acids are situated southeast of the warehouse. The tank farms are surrounded by continuous concrete containment berms. ASTs within the bermed areas are set on raised concrete pads. A current list of ASTs, their capacity and contents is on Table 8A. The floor of the tank farms is concrete. A chemical loading rack for solvents and acids is behind the warehouse.

A covered drumming shed is located next to the acid tank farm. A covered shed for the storage of drums containing chlorinated solvents is located immediately northwest of the drumming shed. Both the drumming shed and storage shed have lined liquid collection trenches and sumps to contain potential spillage and washdown water. A paved outdoor drum storage area is used for other non-chlorinated solvents, alcohols, and acids. Chlorine gases are stored in covered, designated areas outside in back of the warehouse. A railcar unloading area is located next to the solvent tank farm on the southwest side of the warehouse along NW Front Avenue. Plant offices are located in front of the facility on the southwest corner of the warehouse. Another recently constructed, high-density warehouse consisting of approximately 22,000 square feet is located on the northwest corner of the GWCC site. This warehouse, which was constructed in early 1994, is used to store high purity grade chemicals for use by the electronics semiconductor industry.

4.2 Ownership and Operational History

4.2.1 Ownership History

GWC Properties, Inc., a MOCC subsidiary, purchased the GWCC site in late 1982 from Flintkote. Flintkote operated an asphalt roofing materials manufacturing plant on the property for 35 years. Flintkote purchased the property from the Port of Portland in 1946 (see Table 7).

4.2.2 Operational History

Aerial photographs from the 1930s and early 1940s show that the site was vacant of buildings, but may have been used as a log staging area. A boat dock appears in photographs from 1936 and 1948, off the north corner of the property, and a dirt road appears to have led to a cluster of small shacks and to the dock.

Flintkote Operations. Flintkote constructed a plant to manufacture asphalt roofing material. The asphalt shingle manufacturing process apparently involved saturating felt material with asphalt, then coating the felt with asphalt and colored sand granules. Rock dust was used as a filler, presumably in the coating process. There is a record of talc and lime dust storage at the facility. Flintkote may also have manufactured reflective aluminum paint.

A pre-1966 facility map indicates that there were several subgrade conveyors located within the Flintkote plant. The conveyors were located beneath the roofing machine in the back, or northeastern side, of the building, and outside, beneath several granule silos in front of the plant. Overhead conveyors carried granules from the silos and rock dust from the filler house in back of the plant to hoppers above the roofing machine. Several warehouse areas stored finished products. A boiler house and pump house were situated southeast of the plant. Four 18,000-gallon aboveground tanks contained fuel oil for the boiler, saturator asphalt, coating asphalt, and flux for blending the asphalt. The tanks were surrounded by 6-foot-high concrete dikes. Retorts associated with the saturator and coating tanks, and various stills were also present behind the plant and to the southeast, as were a subgrade steel-lined skimmer tank, and a concrete-lined salvage oil pit.

Flintkote operated under various permits from the Columbia-Willamette Air Pollution Authority (CWAPA). In the early 1970s, a filter bag system was installed to collect dust from a rotary kiln inside the filler dryer house; during this period, an electrostatic precipitator and rotoclone were also installed to control saturator emissions. Apparently, there were ongoing problems with precipitator breakdowns and ruptured filter bags after these controls had been implemented. These breakdowns, along with numerous citizen complaints about airborne asphalt particles and opacity violations, were the focus of substantial correspondence between CWAPA and Flintkote. There is also record of two fires at the plant, one in 1967 in the felt coating tank, and one in 1977, when the electrostatic precipitator cells burned.

The Flintkote operation consumed approximately 9,800 tons of asphalt saturant and 4,800 tons of asphalt coating per year, as well as 10,000 barrels of fuel oil. Excess saturant was burned in the boilers. Other solid wastes, including granule scrap and baghouse dust, were reportedly transported off-site to the Portland landfill. Fuel for the boilers was supplied by Shell.

The Flintkote property was not paved, and asphalt transfer piping from the Douglas plant to Flintkote appears to have leaked product onto the ground behind the roofing plant. Before air controls were implemented, the area behind the plant was covered with what appears to be white dust, presumably from the rock filler silos and rotary kiln. Flintkote reportedly disposed of unusable product and asphalt in pits behind the plant. Roofing materials -- shingles and colored granules -- and areas where asphalt was disposed of were observed behind the former Flintkote plant during GWCC construction activities. In addition, Flintkote reportedly used solvents during routine cleaning operations to remove coated asphalt from tools and machinery.

In late 1982, GWC Properties, Inc., purchased the property. In early 1983 GWCC began converting the former Flintkote facility for use by the GWCC operations.

GWCC South Plant Operations.

The southern portion of the GWCC facility primarily receives and stores bulk quantities of industrial (technical grade) chemicals, transfers these chemicals into 5 through 350 gallon steel and polyethylene containers, and distributes the materials to chemical users throughout the Northwest. The facility also receives, stores, and distributes chemicals in 5 up to 350-gallon containers that do not require transferring.

Bulk acids and solvents are received by rail; on several occasions inorganic caustics have been received by rail. Two railcar unloading areas are located immediately southwest of the solvent tank farm (see Figure 8). Transfers from railcars are usually performed via hoses connected directly to the appropriate storage tank. Drip pans are placed beneath pumps and hose connections during transfers. After the offloading of chemicals has been completed, the hoses are stored in contained areas.

Bulk chemicals are unloaded primarily at the loading rack, which is paved with concrete, has concrete containment walls, and is under cover. Bulk chemicals also may be brought in by truck and unloaded in the covered drumming area next to the tank farm. Trucks also may unload outside the covered area next to the tank farms; the area is paved with asphalt.

Bulk chemicals are stored in 28 ASTs ranging from 6,000 to 30,000 gallons in capacity. Each bulk AST is located outdoors and is surrounded by concrete berms within the solvent and acid tank farms. A steel drip pan is installed under the pumps and hose couplings in the solvent tank farm to contain potential leaks. Chemicals typically stored in bulk quantity at the site are listed on Table 8A.

Bulk chemicals are transferred into tanker trucks at the covered chemical loading rack. One side of the rack is reserved for transferring acids; the other side of the loading rack is reserved for transferring solvents. Overhead pipes connect the acid and solvent tank farms to the loading rack. The chemical loading rack area also is sometimes used for rinsing acid trucks. Rinsate and spillage from acid loading activities are collected in sumps and pumped to a wastewater neutralization system. Containers for acids and corrosives are rinsed at the drumming shed. Any solvent spillage is contained and transported via Uniform Hazardous Waste Manifest to a permitted RCRA TSD facility.

A loading rack located southeast of the tank farm was used in the past by GWCC to load caustics onto tanker trucks. This area was not always paved. The rack is now used by the MOCC asphalt facility. The old rack was taken out of service by MOCC; MOCC constructed a new rack in 1994.

Bulk chemicals are transferred into steel or polypropylene drums on sealed concrete and covered drumming areas. Inadvertent acid spillage is collected in a sump and pumped to the wastewater neutralization tank. Solvent spillage in the drumming area is contained, accumulated, manifested, and transported to a permitted RCRA TSD facility for disposal.

The unpaved strip of land between the GWCC facilities and the MOCC marine terminal (see Figure 8) was previously used for exterior truck washing. This practice was discontinued several years ago. Truck washing by MOCC is no longer done in this area. Truck washing by GWCC now takes place in several paved areas. The truck washing company collects washwater onsite and transports it offsite for recycling.

The GWCC facility has secondary containment for its tank farms and transfer operations, except in the railcar unloading area. Most of the outside, uncontained areas have been paved with asphalt since operations began in 1984 (see Figure 8); those areas that were not paved from the beginning were subsequently paved in the intervening years. Incidental acid drippage from the loading rack and drumming areas and wastewater collected inside the plant are pumped to the wastewater neutralization tank; wastewater collected inside the plant also is pumped to the neutralization tank. Water is tested for pH, adjusted if necessary, and then discharged to the city of Portland sanitary sewer in accordance with permit requirements. Rainwater collected in the solvent tank farm is directed to a separate collection tank and discharged under stormwater NPDES permit. If organics in excess of 1.37 parts per million (ppm) are detected in the wastewater, the wastewater is passed through carbon filters for treatment and retested before discharge (see Appendix I).

Spills that may occur in the warehouse are immediately diked, and absorbent material is applied. The material is then swept up and placed into drums for appropriate disposal. Small amounts of spilled powdered material are swept up and evaluated for proper disposal.

A daily walk-through inspection is conducted at the end of the work shift as part of a shut-down procedure to check valves, pumps, hoses, solvent and acid storage and loading areas, and drum storage areas. A comprehensive monthly inspection is also conducted. All inspection records are maintained onsite.

GWCC North Plant Operations

The northern portion of the GWCC operations (formerly known as the Technical Center, and before that Chemax) began operations at the site in early 1984. The facility has produced a number of different products, including water treatment chemicals, such as scale and corrosion inhibitors; dry and liquid industrial cleaning agents and sanitizers; oxygen scavengers; steam line treatment chemicals such as cyclohexylamine; wood treatment products; and concrete additives. Wood treatment products and concrete additives are no longer produced. Current operations involve liquid and dry mixing, drumming of chemicals, washing totes and drums, and handling and managing onsite wastewater.

When operations commenced at the site in 1984, one of the first production processes involved copper sulfate ($CuSO_4$), an algicide. The $CuSO_4$ production area consisted of three mixing tanks and four cooling, or crystallization, tanks. The production area was located outside the warehouse. The tank area also located outside the warehouse was concrete bermed (see Figure 8). Production of $CuSO_4$ was discontinued in approximately 1988.

Chemax also produced chromated copper arsenate (CCA), a wood preservative, in a production area located inside the warehouse from 1984 until 1988. The production area included a storage tank for arsenic acid, one for washdown water, and a third for mixing. Production occurred inside a concrete bermed area; spills drained into a trough and were pumped out for reuse in the process.

Concrete additives for air entrainment, curing, and water reduction were produced from 1984 to 1987. The production area was inside the building; and production occurred in two 5,000-gallon tanks. Raw materials used to manufacture these products included corn syrup, lignins, xylenes, and zinc oxide.

All products currently produced at the GWCC north plant are blended products, most of which are mixed in batches in kettles located in the liquid and dry mixing areas (see Figure 8). Some of the kettles are heated. Liquid products are primarily made in batches of 500 to 6,000 gallons. All chemical mixing now occurs in the warehouse. Prior to 1996, chemicals mixed outside the building included ammonium thiocyanate, and a silicone defoamer containing approximately 60 percent diesel fuel.

The facility also receives and repacks polymers for sale. Some of the raw materials are received and stored in 55-gallon drums, totes, and bags in the warehouse area. Some bulk chemicals, primarily sodium chlorite, are received by rail. Large storage tanks located outside the building are used to store polymers, caustic soda, sodium hypochlorite, and polyacrylic acid; the tanks range in size from 5,000 to 20,000 gallons. Two 4,500-gallon steel storage tanks are used for containing and neutralizing wastewater from inside the plant. All tanks have proper spill containment. Finished products are stored, primarily in 55-gallon drums, inside the warehouse.

From 1984 to 1989, a cooling tower cleaning product was manufactured at the facility which contained hexavalent chromium (Cr^{+6}). The product was used as a tracer and a rust preventative. The product was mixed in a tank or drum, inside the building over a concrete floor with secondary containment inside the production warehouse area. Other chemicals previously handled on site included: formaldehyde, IPA, methanol blends, xylenes, orthodichlorobenzene, and 1,1,1-trichloroethane (TCA). Solvents currently being used include the following: a blend containing Chevron 350B, kerosene (used in silicone defoamer), and methylene chloride. Solvents are pumped out of drums into mixing tanks in the liquid mixing area. Partial drums are saved to be used in subsequent batches. Small amounts of solvents are also used in the testing laboratory for cleaning glassware.

Containers that held primarily caustics are rinsed in a designated, contained area located inside the plant. The drumming area floor is concrete with a fiberglass coating on the surface. Some containers (primarily metal) are sent to Myers Drum or Northwest Cooperage for recycling; others (primarily polypropylene) are stored outside and saved for reuse.

Floors inside the plant are high pressure washed daily to several times per day. Water runs into floor gutters and sumps, and is then pumped into the neutralization tanks. From there it is discharged, in compliance with GWCCs industrial wastewater pretreatment permit requirements, to the City of Portland sanitary sewer. Wastewater is tested for pH. Remaining pollutants of concern are monitored semiannually in March and September. The City previously required testing for liquid amines because of their flammability and corrosivity. However, since the wastewater is pH adjusted and amines were of consistently low concentration, this requirement was suspended. Analytical reports from the laboratory are maintained onsite.

4.2.3 Permits

GWCC operates under several permits, including a City of Portland industrial wastewater discharge permit (No. 400-003), an NPDES permit from the DEQ for stormwater discharge, and 1200-H tank permits from the fire department.

4.2.4 Waste Handling Practices

Solid-Phase Wastes. Solid-phase wastes generated at south plant operations (formerly the Portland Branch) are limited to container residues, minor amounts of sludge from sumps, absorbent material used to clean up small spills, and chemical material from torn bags. Materials from the airborne dust collection system are neutralized monthly and disposed under the industrial discharge permit.

Prior to 1994 the Technical Center was registered as a small quantity generator, separate from the Portland Branch, a large quantity generator. Since 1994 the combined facilities operate under a single large quantity generator permit.

Wastes generated at the north plant operations (formerly the Technical Center) include: solids from wastewater collection sumps, absorbent material used to sweep up small spills, off-specification products, and small amounts of flammables, acids, and solvents. When CCA and $CuSO_4$ were produced at the facility, these processes generated some residual material that could not be reused. That material was removed, containerized, and transported by Uniform Hazardous Waste Manifest as an off-specification product, to the permitted RCRA TSD facility in Arlington, Oregon (Arlington).

The former Technical Center at one time received spent copper sulfate and chromic acid, which are by-products of the fabrication of printed circuit boards. The plant attempted to recover some of these materials for use in the $CuSO_4$ and CCA processes. The virgin chemical materials originated in California and were shipped to GWCC for distribution to electronics manufacturers. The spent materials from the electronics manufacturers were then returned to GWCC and were either distributed to the Technical Center or were transported back to the original California manufacturer. The DEQ files contain substantial correspondence between GWCC, the state of Oregon, and the state of California as to how these materials should be classified. The Technical Center discontinued its attempt to recycle the material. The material was disposed at a RCRA TSD facility in Arlington, Oregon.

Liquid-Phase Wastes. Wastewater from the north plant and south plant portions of GWCC is collected separately and directed to separate outside wastewater neutralization tanks at each facility. Rainwater from the solvent tank farm in the south plant is discharged under NPDES permit. North plant operation washdown water in the mixing areas is collected in sumps and stored in drums to be used in subsequent batches of the same product.

4.3 Site Investigation and Regulatory Inspection History

Since 1985 several environmental related studies have been conducted in the north plant area (formerly the Technical Center) at the request of GWCC. In 1984, a site risk assessment was conducted as a requirement for obtaining a pollution liability insurance policy (RSI, 1984). In 1990, two test borings were drilled, and one monitoring well was installed near the former $CuSO_4$ evaporation structure as part of GWCCs investigation of a possible release from that area (EMCON, 1990). In 1993, four additional monitoring wells were installed in response to a suspected historical release in the former CCA production area. These studies are summarized below. Analytical results are contained in the referenced reports, available at MOCC corporate headquarters.

4.3.1 Environmental Risk Assessment

Shortly after beginning operations at the site, GWCC commissioned an environmental risk assessment of the Technical Center as a requirement for obtaining a quotation for environmental impairment liability insurance. Risk Science International (RSI) evaluated plant operations and prepared a report. The report concluded that the risk of gradual environmental impairment from operations at the plant was low-to-moderate. The RSI report also concluded that the risk had to do with the hazardous nature of the materials handled at the plant and a slight potential for spills and impact of stormwater runoff (RSI, 1984).

4.3.2 Copper Sulfate Containment Structure Excavation

Part of the $CuSO_4$ formulation process included the use of a containment structure for process water. The containment structure was located below grade and lined with concrete and fiberglass. The structure was approximately 20 feet long by 15 feet wide and 3 feet deep. Following cessation of the $CuSO_4$ formulation operation in late 1987 or early 1988, the structure was used for a short time to hold process water from the CCA formulation operation. Use of the containment structure was discontinued in 1989.

Assessment and remedial activities were undertaken by GWCC when it was discovered that the containment structure had developed a crack in the concrete that lined the bottom of the structure. These activities are summarized in an October 22, 1990, letter from Lee Zimmerli of GWCC to Mr. John Odisio of the DEQ (GWCC, 1990).

EMCON (now IT Corporation) was retained by GWCC to evaluate groundwater impacts before excavating the structure. The removal of the structure and overexcavation of surrounding soils was undertaken by Chemical Waste Management, Inc. (Chem Waste).

EMCON advanced two test borings adjacent to the containment structure. No visible soil staining was observed. Arsenic was detected in one groundwater sample at 0.009 mg/L, below the MCL of 0.05 mg/L. Soil samples from each boring were analyzed for TCLP metals. Barium was detected in soil at concentrations up to 0.22 mg/kg (EMCON, 1990).

Following removal of the structure and surrounding soil, EMCON prepared a composite sample from the sidewalls of the excavation. The results of laboratory analysis indicated that concentrations of copper, chromium, and arsenic remaining in the excavation did not represent a threat to human health or the environment (EMCON, 1990).

4.3.3 CCA Cleanup and Characterization

Background. From 1984 until 1988 Chemax formulated and distributed a product containing 50 percent CCA under the subregistration name of "Woodlast." The CCA product was stored and mixed in three 5,000-gallon tanks located inside the Chemax facility (see Figure 8). In 1992, during the construction of two concrete sumps in the former CCA formulating area, GWCC maintenance and production workers discovered discolored concrete, gravel, and subsurface soils in the area below the concrete floor on the northeast side of the warehouse. Upon discovery, GWCC contracted with EMCON to assist in investigating environmental impacts. A report was prepared summarizing the investigation and cleanup activities (EMCON, 1994).

In response to the discovery of the release, soil and debris were removed and disposed of at a permitted RCRA TSD facility. Soil and debris were classified as characteristic hazardous waste (waste codes D004 and D007). The area excavated was approximately 20-foot wide by 40-foot long and ranged to 14-foot deep. The average depth of the excavation was approximately 8 to 10 feet.

Discrete samples were collected and analyzed for CCA during the removal process to confirm that the cleanup objectives were met. The arithmetic mean of the discrete soil sample concentrations for CCA was below the cleanup criteria. Following confirmation sampling, the excavation was backfilled and the concrete floor repaired.

A groundwater assessment was also conducted in the area of the CCA release. Monitoring well locations are shown on Figure 9. Concentrations of copper, chromium, and arsenic have been detected in groundwater above applicable regulatory criteria. However, no monitoring well has consistently exceeded USEPA-established maximum contaminant levels (MCL) for chromium or arsenic.

5 GREAT WESTERN CHEMICAL CO. WASTE CHARACTERISTICS

5.1 Potential Sources of Hazardous Substances

5.1.1 Products Stored at the Facility

Little is known about the products stored at the Flintkote facility from 1947 to 1982. Flintkote products probably included asphalt, fuel oil, and flux material, stored in 18,000-gallon ASTs surrounded by 6-feet-high concrete berms. It is also possible that kerosene or solvents would have been stored for use onsite to remove asphalt from equipment and machinery. A 1,000-gallon UST, apparently used for gasoline and formerly located in the southeast loading dock area, was installed by Flintkote in 1953 (SAFE, 1994). This tank was removed in 1989 (Hahn and Associates, 1989). Two soil samples collected in the excavation contained 37 ppm and 69 ppm TPH, which was below the DEQ's soil cleanup level of 80 ppm determined by using the DEQ soil cleanup level decision matrix (Hahn and Associates, 1989).

An unregulated heating oil tank, located in the southwest loading dock area, was formerly used to store fuel for the plant boiler. The 6,000-gallon tank was apparently located partially below grade. It had not been used since late 1979. In March 1994, the tank was cleaned and decommissioned by filling it with concrete.

Products currently stored in bulk quantity at GWCCs south plant area include a variety of acids and solvents, which are stored in ASTs ranging in capacity from 1,500 to 30,000 gallons (see Table 8A and Figure 8). Solvents and acids are segregated into separate tank farms surrounded by concrete secondary containment structures.

In addition to the bulk materials stored in ASTs, a wide range of products packaged in 55-gallon steel and poly drums, tote containers, and bags are also stored on-site. These products include the following: acids, solvents, caustics, oxidizers, food-grade chemicals, corrosives, alcohols, flammables, and gases (chlorine only). Packaged products are segregated by class. Oxidizers, corrosives, food-grade and other hazardous chemicals are stored in designated areas in the main warehouse. Flammables are stored in designated areas on asphalt pavement outside the warehouse (see Figure 8). Chlorinated solvents are stored in drums in a covered shed with secondary containment. Chlorine cylinders are stored in a covered concrete area next to the back of the warehouse. High purity grade products for use by the semiconductor industry have recently been moved to the new warehouse located on the northwest corner of the site.

Products stored in bulk quantity in the North Plant area include the following: various polymers, caustic soda (50 percent solution), polyacrylic acid, and sodium hypochlorite (12.5 percent solution). These products are stored in outside ASTs surrounded by concrete and poly containment structures (Table 8A). Other raw materials and finished products are packaged in 55-gallon drums, 220 to 350 gallon totes, and bags. The majority of these products are stored inside the warehouse.

From 1984 to 1988, the north plant (formerly Technical Center) stored raw materials used for copper sulfate production, including sulfuric acid and spent $CuSO_4$. Sulfuric acid was stored outside in a 6,000-gallon AST in the $CuSO_4$ process area. Spent $CuSO_4$ received from the electronics industry was stored in drums outside along the northeast side of the warehouse. Arsenic acid and chromic acid, raw materials used in blending CCA, were stored at the site from 1984 to 1989. From 1984 to 1989, hexavalent chromium (Cr^{+6}) was used in the production of cooling tower chemicals. The Cr^{+6} solution was mixed and stored in the Stock 5 tank. Corn syrup, formaldehyde, and sodium chlorite also were previously stored onsite, in outside ASTs provided with secondary containment.

Chemicals currently used in the north plant operations are listed on table 8B Solvents previously used at the Technical Center include IPA and methanol blends (used for airline antifreeze); ADI (anti-detonant injection mixture), which may have been a methanol blend; and xylenes, mixed with zinc oxide in Azcon (a concrete additive formerly produced on-site). Each of these products was formulated in the liquid mixing area.

The various products stored at the site represent potential sources of hazardous substances releases primarily under circumstances of containment failure. Tank failures could result in a release to secondary containment structures. Pipeline failures could result in a release of product to the ground if failure occurred in an unpaved area. In such an instance, or in the unlikely case of secondary containment failure, a release could impact the soil, surface water, air, and groundwater pathways. Failure of packaged products containers in the warehouse, or drums and totes in the yard, could also result in releases of hazardous substances. Cleanup procedures at GWCC include the use of personal protective equipment and health and safety procedures to reduce direct contact with hazardous substances.

5.1.2 Wastes Generated and Managed on the Site

Solid-phase wastes generated at the GWCC site are primarily absorbent material used to clean up spills, scrapings from polymer tanks and transfer operations, and packaging from raw materials. Because the north plant now manufactures blended products, waste from its operations is greatly reduced. Liquid-phase wastes include floor washdown water from inside the warehouse and north plant, and surface drainage from the outside paved areas. Past and present waste handling practices are discussed in Section 4.2.4. Solid-phase wastes generated at the GWCC facilities have never been disposed of on site. Final disposition of solid-phase waste is accomplished by off-site transport to a local landfill (if determined nonhazardous), to the Chem-Security, Inc., landfill in Arlington, Oregon (if determined hazardous), or, in the case of the polymer scrapings, to a Laidlaw, Inc., facility in the eastern United States for incineration. Wastewater, as discussed in Section 4.2.4, is discharged under permit to the City of Portland sanitary sewer, and stormwater is discharged under an NPDES permit to the Willamette River.

On-site disposal of asphalt by the former Flintkote facility could impact the soil; however, the solid nature of asphalt (i.e., physical/chemical properties) minimizes its migration. It is also unlikely that buried asphalt would affect the groundwater pathway. Subsequent asphalt paving of the site also reduces the likelihood that buried asphalt would impact the air, surface water, or groundwater pathways.

5.1.3 Potential Sources Identified From Site Assessments

Two potential sources have been identified by previous site assessments. Low concentrations of copper, chromium, and arsenic are present in groundwater as a result of a release to soil in the former CCA process area (EMCON, 1994). Sidewall samples taken from the excavation of the former copper sulfate evaporation structure indicate that low concentrations of copper, chromium, and arsenic remain in soil (EMCON, 1990).

6 CONCEPTUAL SITE MODEL

Development of the conceptual site model (CSM) is an important step in designing this RI Proposal. The CSM identifies the sources, pathways and receptors that should be considered in designing the remedial investigation (RI) workplan. Although MOCC and GWCC operate independently, the CSM covers both facilities. The single CSM approach is the most practical way to define site characteristics because the two facilities are adjacent to each other, and have potentially overlapping exposure pathways to the Willamette River.

The CSM prepared for the site is illustrated on Figure 10. Reading Figure 10 from left to right traces the site's potential exposure pathways from potential source areas to potential receptors. The CSM considers all media: including soil, groundwater, surface water, sediment, and air.

The CSM divides the site's primary potential release mechanisms into releases from upland operations and releases from offshore dock operations. The following discussion is subdivided by secondary sources: surface soil, subsurface soil, groundwater, stormwater, and the Willamette River. The transport mechanisms, potential tertiary sources, and potential receptors are discussed.

6.1 Potential Receptors

The four classes of potential receptors identified on Figure 10 were determined based on current and reasonably likely future land use. The site and surrounding area are currently in industrial use, are zoned industrial and are likely to remain industrial for the foreseeable future. This means that potential human exposure evaluations should not include residential scenarios.

The potential types of human exposure include both onsite and offsite pathways. The primary onsite population potentially exposed are the employees of MOCC and GWCC. A second onsite group with far lower potential frequency or duration of exposure are trench workers who may come on site for construction, repair, or maintenance of underground industrial facilities. The third population considered in the CSM are the recreational users of the Willamette River.

For the purposes of this CSM, all flora and fauna potentially exposed to river water or sediments are lumped under the heading of ecological receptors.

6.2 Surface Soil

For this CSM surface soil is defined as the soil less than three feet below ground surface. Surface soil can be impacted by surface releases in unpaved areas, and by releases from underground tanks (USTs) or underground drains/pipelines. All site manufacturing and other industrial operations on the site occur in paved areas or within buildings (see Figure 6). The pavement consists of asphaltic concrete or concrete. The buildings and pavement prevent surface releases from impacting soil.

The only unpaved area is the gravel parking zone between GWCC and MOCC operations. This area is owned by the Port of Portland and is used for temporary parking of trucks and trailers. No industrial operations take place in this area. Stormwater from this area goes to the MOCC Oil Water Separator prior to NPDES discharge.

Where paved surface soil has been impacted by USTs or subsurface drains/pipelines the possible exposure pathways that must be considered include inhalation of dust and volatiles, direct ingestion, dermal contact, and leaching to groundwater. Stormwater runoff from the unpaved parking area between GWCC and MOCC is discussed under section 6.4

Because all outside onsite industrial operations occur on paved areas, the outdoor inhalation pathway from surface soil is incomplete for all receptors except the onsite trench worker. Future subsurface construction or maintenance activities in paved areas onsite could infrequently expose trench workers for brief periods. There is a potential for volatile surface soil contaminants (if present) to penetrate building foundations, making onsite workers and excavation workers potential receptors of volatile indoor air contaminants.

The potential for direct ingestion and dermal contact with surface soils is only possible for future trench workers because of the presence of pavement and buildings on site.

There is a potential for leaching from surface to subsurface soil, but this is very limited over most of the site because pavement and buildings prevent infiltration of rainwater and stormwater. This pathway is further discussed under subsurface soil, section 6.2.

The only potential receptors for surface soil are the onsite worker for indoor air, and the future trench worker who could be exposed to soil below pavements or buildings during construction/maintenance activities.

6.3 Subsurface Soil

The Willbridge industrial area, including the site, is situated on fill dredged from the Willamette River. The dredged sediments were used to fill lakes in the area from the early1900's to the 1940's. The upper 20 to 35 feet of sediments beneath the site and the surrounding vicinity consist of fine-to medium-grained silty, sandy dredge-spoils. The fill layer is generally homogeneous, with some silt and clay lenses. The fill overlies the original surface of lake bottom sediments, marsh silts, and alluvial silts and silty clays.

Beneath the site, the alluvium is encountered at approximately 20 feet below ground surface (bgs), and is characterized by interbedded gray silt and clay with lesser amounts of sand (EMCON. 1994). The MOCC marine terminal is situated on more recently dredged silty, sandy fill material, overlying alluvial silts and clays. Cross sections of the site provide a general illustration of the site geology (Figure 11).

The pathway and receptor analysis for subsurface soil is similar to the one for surface soil with a couple of exceptions. Contaminants present in subsurface soil that are within or below the seasonal zone of groundwater fluctuation have a potential leaching pathway to groundwater. Review of Figure 10 shows that the potential receptors for contaminants present in subsurface soil are the same as surface soil: that is, indoor air for site workers, and ingestion, dermal contact, inhalation for trench workers. The soil to groundwater pathway is further evaluated in the next section.

6.4 Groundwater

The uppermost aquifer is unconfined at the site. Groundwater migrates southwest to northeast across the site from the Willbridge Terminal to the Willamette River (Figure 4). The Willamette is the regional discharge boundary for shallow and deep groundwater. The site watertable contours mapped for February 1999 are on Figure 9. The contour pattern and flow direction indicated on Figure 9 have been consistent, with minor seasonal fluctuations, throughout the past five years of monitoring at the site.

Groundwater in the uppermost aquifer occurs in the dredge spoil sands, above the contact between the dredge spoils and the underlying pre-fill sediments. The pre-fill alluvial sediments are generally siltier than the dredge spoils. The fine grained nature of the pre-fill alluvium has a perching effect on groundwater in the overlying dredge fill. Depth to groundwater ranges from approximately 13 to 19 feet across the site. Recharge to groundwater is primarily from underflow upgradient of the site, because onsite infiltration of incident precipitation is prevented by buildings and pavement over most of the site.

There is no onsite use of groundwater because the facility uses the public water supply for potable and industrial purposes. Therefore, there is no groundwater exposure pathway for onsite workers, except potentially through volatilization from groundwater upward through the vadose zone into indoor air. There is a remote potential for brief exposure of future excavation workers in deep excavations that are near the base of the vadose zone or below the watertable. There is no pathway for groundwater exposure of recreational river users or ecological receptors.

Previous studies at the site have identified petroleum hydrocarbons and solvents in shallow groundwater at the site. The solvents have not been detected in monitoring wells along the river shoreline, but the petroleum hydrocarbons were detected. The groundwater quality data for the site are presented in Section 8. These contaminants may discharge at low concentrations directly to the Willamette River. This potential groundwater discharge could affect river water and sediment quality and will be further discussed in the Willamette River Section 6.6.

The CSM shows that site groundwater could affect site workers via indoor air, and future trench workers. Through the Willamette River pathway, groundwater discharges could potentially expose recreational river users and ecological receptors that contact river water and river sediments.

6.5 Stormwater

Stormwater discharges to the Willamette River from MOCC and GWCC is allowed under two NPDES permits. The MOCC and GWCC facilities have separate stormwater collection and routing systems that are shown on Figure 6. The MOCC 1300J and the GWCC 1200Z NPDES stormwater quality criteria are the same and are summarized on Table 10.

TABLE 10

McCall AND GWCC

NPDES STORMWATER QUALITY CRITERIA

PARAMETER	LIMITATION
Oil & Grease	Shall not exceed 10 mg/l
pH	Shall be between 6.0 and 9.0
Oil & Grease	No visible sheen
	BENCHMARK
Total Copper	0.1 mg/l
Total Lead	0.4 mg/l
Total Zinc	0.6 mg/l
Total Suspended Solids	130 mg/l
Floating Solids(associated with industrial activities	No visible discharge

There are no potential stormwater exposure pathways to onsite workers or future trench workers. Through the Willamette River pathway, stormwater discharges could potentially expose recreational river users and ecological receptors that contact river water and river sediments.

6.6 Willamette River

Within the CSM, the Willamette River is both a potential secondary source of contamination and a pathway to contamination of river sediments. The river is exposed to groundwater and stormwater discharges from the industrial uplands portion of the site, and to releases from the offshore material transfer operations at the MOCC dock.

River exposure pathways that may exist for onsite workers or future trench workers are the same as those considered for the public under recreational activities. Therefore, the onsite workers and future trench workers are not considered to have a separate exposure to river water or sediments.

There are potential river recreational and ecological receptors of contaminants that reach the river from onsite groundwater, onsite stormwater, or from direct releases of materials at the MOCC dock.

7 HISTORY OF RELEASES

7.1 McCall Oil & Chemical

Releases of petroleum products have occurred at the asphalt plant and the marine terminal tank farms according to the recollections of site personnel and available DEQ documentation. The majority of the release incidents involved volumes of product ranging from approximately 1 gallon to several thousand gallons of asphalt or bunker fuel (see Table 5). The release locations are shown on Figure 7. Releases were cleaned up immediately by MOCC personnel. Figure 7 and Table 5 have been updated since the 1994 Preliminary Assessment.

There have been no major spills of diesel at the facility. These releases have been responded to immediately; and free product has been recovered and impacted soil removed, if required. The majority of diesel spills are small and are associated with leaking pump packings over concrete secondary containment.

The majority of releases that have occurred at the site involved asphaltic materials or heavy black oil (i.e., bunker fuel). Asphalt is a solid at ambient temperatures and is thus not expected to migrate. Further, asphalt does not meet the definition of "oil" under ORS 465.200(11) and is not a hazardous substance. Black oil is semi-solid (tar-like); at ambient temperatures its potential for migration would be limited. Table 6 summarizes physical properties of the asphalt and heavy oil products handled by MOCC.

7.2 Great Western Chemical

Flintkote operations resulted in releases of asphalt, both from apparent leaking pipelines and from apparent disposal of asphaltic materials behind the facility.

Spills of chemicals have occurred at the site from GWCC operations (see Table 9). The majority of these spills have been contained within bermed areas and have been cleaned up without a release to the environment. A release of Cu_4 from an evaporation structure was discovered when the structure was abandoned in 1989; the containment structure (concrete liner) was apparently cracked. A release was also discovered in 1993 beneath the former CCA process area, during excavation activities for a new sump. The locations of historical releases are shown on Figure 12.

8 SUMMARY OF WATER, SOIL, AND SEDIMENT DATA

8.1 Sediment Data

The Portland Harbor Sediment Investigation Report (Weston, 1998) cited six Willamette River sediment sampling locations near the site. Sample locations SD114, 115, 117, 118, 120 and 123 are shown on Figure 9. The Weston investigation obtained surface sediment samples (0 to 10 cm depth) at all locations. Subsurface core samples were also obtained at locations SD 117 and SD 120 (0 to 90 cm depth).

The samples were tested for inorganic, semi-volatile organic, organic, pesticide and organotin compounds. On pages 2 and 3 of the Oregon DEQ's March 31, 2000, Voluntary Agreement with MOCC/GWCC, the agency listed the following compounds that exceeded baseline concentrations established for the Portland Harbor Study Area:

MOCC/GWCC Surface Sediments Constituents Exceeding Baseline Values:

aluminum	zinc
cadmium	4-methylphenol
cobalt	butylbenzylphthalate
lead	di-n-octylphthalate
mercury	

MOCC/GWCC Subsurface Sediments Constituents Exceeding Baseline Values:

aluminum	4-methylphenol
barium	dibenzofuran
cobalt	LPAH
mercury	HPAH
zinc	

With one exception all of the constituent concentrations were well below dredge screening criteria. The exception was the shallow sample from SD120 that had a 4-methylphenol concentration of 880 micrograms/kg. The dredge screening criteria for this compound is 670 micrograms/kg.

For the purposes of this RI Proposal we will term the above list of constituents the site chemicals of potential concern (COPCs).

8.2 Stormwater

Under their respective NPDES permits, MOCC and GWCC test stormwater for the constituents listed on Table 10 (page 6-4). With a few minor exceptions, MOCC and GWCC have met their stormwater permit monitoring criteria.

8.3 Groundwater

MOCC and GWCC have been monitoring groundwater since 1994. There are eleven monitoring wells in the network (Figure 9). The monitoring wells are all less than 30 feet deep and are designed to monitor the uppermost aquifer at the site.

Groundwater has been tested for Total Petroleum Hydrocarbons (EPA methods 3510/8015 modified) and for volatile organic compounds (VOCs) using EPA method 8260A. The water quality data from 1994 through 1999 is summarized on Table 11.

The water quality constituent concentration trends are shown graphically for representative wells on Figure 13.

The water quality data show that shallow groundwater at the site has fairly widespread low level concentrations of diesel and other undifferentiated hydrocarbons in the heavier oil range. Monitoring well EX-1 is downgradient of the solvent tank farm and has moderate concentrations of chlorinated solvents. Well EX-6 is downgradient of EX-1 and has trace concentrations of chlorinated VOCs. The wells adjacent to the Willamette have had no detections for VOCs.

The monitoring data to date indicate that shallow groundwater with low concentrations of diesel and heavy oil appears to be discharging to the Willamette River from the site. The concentrations of petroleum hydrocarbons in the site wells have been fairly consistent, with seasonal variations. No free petroleum product has been detected in groundwater at the site. The petroleum hydrocarbon contribution from the upgradient Willbridge terminal has not been determined.

8.4 Soil

Soil samples were obtained during installation of six site monitoring wells. The data from these samples is summarized on Table 12. The soil samples were field screened using a flame ionization detector and two soil samples from each borehole were tested for Total Petroleum Hydrocarbons using EPA methods 3540/8014 modified.

Soil from the upper five feet of boreholes EX-1, -2, -5, and -7 contained oil that was quantified using 30 weight motor oil as the lab standard. The oil concentrations ranged from 28 to 321 mg/kg. No fuel hydrocarbons were detected in any of the soil samples. The samples from boring EX-3 had no hydrocarbon detections. The shallow soil sample from boring EX-6 had an oil concentration of 4,400 mg/kg.

There were no hydrocarbons detections in any soil samples derived from depths greater than five feet. This indicates that there is little oil present in the groundwater table fluctuation zone.

8.5 Identification of Data Gaps

The conceptual site model (Section 6), history of releases (Section 7), and the summary of site data (Section 8) were evaluated to identify data gaps for further evaluation. This evaluation consisted of identifying the complete exposure pathways identified in the CSM and determining where data are required to evaluate those pathways.

8.5.1 Releases From Upland Operations

The CSM (Figure 10) shows that site groundwater and stormwater are the only secondary sources from site upland operations that could affect human and ecological receptors at the Willamette River. There are ongoing stormwater and groundwater monitoring programs in place at the site. The groundwater and stormwater monitoring programs are discussed in Sections 8.2 and 8.3. The existing monitoring programs do not include testing for any of the Chemicals of Potential Concern (COPCs) detected in Willamette River sediments near the site and listed in section 8.1. Groundwater and stormwater quality data for the COPCs is therefore a potential data gap.

The CSM showed that site upland surface and subsurface soils are potential secondary sources that could result in exposures to onsite workers and future trench workers. Existing soil quality data from previous borings was discussed in Section 8.4. Site soil has not been tested for the COPCs. Site soil quality data for the COPCs is therefore a potential data gap.

8.5.2 Releases From MOCC Offshore Dock Operation

The CSM showed that releases from the MOCC offshore dock could affect Willamette River water and sediment quality. MOCC has not obtained any information on river water or sediment quality at the dock facilities. River water and sediment quality data for the COPCs is therefore a potential data gap.

9 RI OBJECTIVES

The objectives of the MOCC and GWCC RI were developed from the objectives identified in Attachment B of the March 31, 2000, Agreement and Scope of Work prepared by DEQ for this site.

A. Identify and Characterize Upland Hazardous Substance Source Areas

B. Evaluate Contaminant Migration Pathways from Upland to River

C. Determine Nature and Extent of Upland Affected Media

D. Identify Human and Ecological Receptors

E. Collect Upland Data to Allow Identification of Possible Areas of Sediment Contamination

F. Conduct Risk Assessment

G. Determine if Upland Hot Spots are Present

H. Achieve Adequate Data Quality for Site Characterization and Risk Assessment

10 INVESTIGATION PLAN

10.1 Status of RI Objectives

RI objectives A and B have been largely completed through the efforts of the 1994 Preliminary Assessment, preparation of this RI proposal, and the monitoring that has occurred since 1994. This RI proposal has documented the areas of MOCC and GWCC industrial activity and locations of documented releases. This information was an important criterion used in the design of the existing groundwater and stormwater monitoring programs. Existing stormwater and groundwater monitoring points are located downgradient of historic release areas and the most active areas of industrial operations.

This RI proposal has evaluated potential exposure pathways through the Conceptual Site Model that was described in chapter 6. The investigative work already completed at the MOCC and GWCC facilities has identified potential source areas and migration pathways to the degree necessary to identify data gaps.

RI objective C has not been completed primarily because the COPCs have not been analytical targets in any past investigations or monitoring programs at the site.

RI objective D has been largely completed through the Conceptual Site Model analysis described in Chapter 6. The CSM identified the human receptors that should be evaluated. The CSM did not identify individual ecological receptors that may exist on the upland portion of the site, or in the river. There are no known unique river environments on the site; therefore it is assumed that some of the potential ecological receptors identified by DEQ for the Portland Harbor exist on the site. The upland portion of the site is covered with buildings or pavement and there are no wetlands on the uplands. There are no known ecological receptors on the upland portion of the site.

Contaminant transport pathways will be further evaluated in the RI to allow identification of possible areas of sediment contamination as required in objective E. The effort will focus on pathways from the upland to the river. This RI will not include an investigation of the river itself, since a river investigation is planned to be performed by a group of potentially responsible parties.

Objective F will be met with completion of a focused risk assessment.

Additional data on groundwater and stormwater quality will be obtained to meet RI objectives C and E. To meet objective G these data will be evaluated for indicators of the possible presence of an upland hot spot.

The RI workplan will include data quality objectives required to meet objective H.

The RI will be designed to gather the necessary data to evaluate source control measures to meet objective I, should the risk assessment indicate such measures are needed.

10.2 Phased Investigation

Evaluation of the current status of completion of RI objectives (Section 10.1) showed that RI objectives A, B, and D are largely complete because of work previously conducted at the site and the analyses in this RI proposal. Phase 1 of the RI should therefore focus on completing objectives C and E that will provide adequate information to complete the focused risk assessment for objective F.

Groundwater and stormwater transport are the potential pathways that could carry COPCs from the upland to the river. If upland soil is contaminated with COPCs, the potential migration pathway from the soil to the river is groundwater. Additional monitoring of groundwater and stormwater will therefore fill the potential upland data gaps identified in Section 8.5. The additional monitoring will determine if COPCs exist in groundwater or stormwater at the site. If COPCs are present in significant concentrations, additional monitoring points may be required to fully delineate the extent of contamination in groundwater or stormwater. Should COPCs be present in significant concentrations in groundwater or stormwater, additional soil data may be required to delineate source areas.

Phase 1 of the RI is proposed to consist of sampling all existing site monitoring wells and testing the groundwater for the COPCs listed in section 8.1. Phase I will also include sampling stormwater and sediment from four stormwater discharge points. Three of the discharge points are catchbasins on the GWCC site and one discharge point is the oil water separator on the MOCC site. Figure 6 shows the locations of the three GWCC catch basins and the MOCC oil water separator.

The data from the Phase 1 groundwater and stormwater/catchbasin sediment testing will be presented to DEQ in a status report. The MOCC/GWCC and IT Corporation project managers will meet with DEQ to discuss the results and the possible need for additional data.

If MOCC/GWCC and DEQ agree that the data are conclusive with respect to RI objectives C and E, the focused risk assessment will be completed with the new data.

The schedule required to complete Phase 1 of the RI should be determined after DEQ has agreed on the general plan of Phase 1.

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LIMITATIONS

The services described in this report were performed consistent with generally accepted professional consulting principles and practices. No other warranty, express or implied, is made. These services were performed consistent with our agreement with our client. This report is solely for the use and information of our client unless otherwise noted. Any reliance on this report by a third party is at such party's sole risk.

Opinions and recommendations contained in this report apply to conditions existing when services were performed and are intended only for the client, purposes, locations, time frames, and project parameters indicated. We are not responsible for the impacts of any changes in environmental standards, practices, or regulations subsequent to performance of services. We do not warrant the accuracy of information supplied by others, nor the use of segregated portions of this report.

TABLES

Table 1

McCall Oil & Chemical Corporation
Portland, Oregon
Summary of Information Sources

Aerial Photographs

Northern Light Studio, Portland, Oregon
Photograph OHP 2611E (1956); BRU #146E (1940); P077 11-19E (1977)

U.S. Army Corps of Engineers, Portland District, Portland, Oregon
Photographs #3403 (1971); #39 (1948); 67-953 (1967); 23-5865 (1936); 61-3755 (1961); 76-175 (1976)

Spencer B. Gross, Portland, Oregon
Photographs SBG-Metro-75 #26 (9-18-75); SBG Metro 90 #26-54 (8-4-90); SBG Port-Will 2-10 (8-3-93); SBG-Metro-66 #14-26 (1966); SBG-Metro-80 #26-45 (1980); SBG-Metro-84 #26-45 (1984); SBG-Westside-92 #8-28 (1992)

Consultant Reports

Hart Crowser (January 29, 1993)
SEACOR (Chevron - June 15, 1993)
SEACOR (Union Oil - June 15, 1993)

Fire Department Records

Portland Fire Bureau records:
- Oil burner & liquified petroleum gas (LPG) permits
- Gasoline & motor oil storage tank permits
- Oil and compressed gas storage tank permits
- Abandoned storage tank permits
- Inspection records

Geology Reports

Beeson et al. (1991)

Ground Water Reports

Brown (1963)

Historical Occupant Records

City Directories, Portland, Oregon, 1993, 1985, 1980-81, 1975, 1970, 1965, 1960, 1955, 1943-44, 1935 and 1931

Historical Maps

Sanborn Fire Insurance Maps, 1965, 1955, 1932

Plumbing and Sewer Permits

City of Portland, Bureau of Buildings, plumbing inspection reports and permits

Public Agency Records

City of Portland, plumbing and sewer records

Table 1

McCall Oil & Chemical Corporation
Portland, Oregon
Summary of Information Sources

Regulatory Agency Lists/Files

- Oregon DEQ Lists:
- Active permits (January, 1994)
- Confirmed Releases List (December, 1992)
- National Pollution Discharge Elimination System (NPDES) permits
- Resource Conservation and Recovery Act (RCRA) Region 10 Report: Hazardous Waste Generators, Transporters, and Treatment-Storage-Disposal Facilities (March 10, 1993)
- Water Pollution Control Facility (WPCF) permits
- Comprehensive Environmental Response, Compensation, and Liability Information Systems (CERCLIS) EPA Superfund Program List (April, 1993)
- Environmental Site Cleanup List (April, 1993)

Agency Files

Columbia-Willamette Air Pollution Authority files for Pioneer Flintkote Company
DEQ agency files for McCall Oil and Chemical Corporation, Great Western Chemical Company, and Chemax

Corporate Files

McCall Oil and Chemical Corporation
Great Western Chemical Company

Title Records

Multnomah County Assessor, Tax Lot Maps (1993)
County Recorder Records (1940 to present), site history records

Topographic Maps

U.S. Geological Survey (USGS) Portland, and Linnton, Oregon, 7.5-minute quadrangle maps

Transformer Information

Portland General Electric (PGE), PCB test data

Water Rights and Water Wells

Oregon Water Resources Department records

Well Logs and Water Rights

Oregon Department of Water Resources records

Table 2
McCall Oil and Chemical Corporation
McCall Information Sources

I. Employee Interviews

Employee Name[a]	Employer	Title	Dates of Employment
Bernie Fischer	Douglas	Plant Operator	1967-72; 1980-82
John Clohessy	McCall	Asphalt Plant Foreman	1984 to present
Vance Stasna	McCall	Maintenance Supervisor For Terminal and Asphalt Plant	1988 to present
Geary Powell	McCall	Site Manager	1984 to present
Greg Lathrop	McCall	Terminal Operator	1978-1983; 1989 to present
Ron Brown	McCall	Lead Foreman	1978 to present
Richard Arrasmith	McCall	Terminal Manager	1974-1982
Dave Baugher	McCall	Terminal Manager	Present

[a] Employee intereviews were conducted on January 27 and 28, 1994 at the McCall Oil facility

II. Environmental Reports

- Environmental Risk Assessment Report, prepared by Risk Science International, Washington, D.C., April 15, 1985.
- Spill Prevention Control and Countermeasure Plan, prepared by Hart Crowser, Portland, Oregon, September 17, 1992.
- Preliminary Assessment of Shell Willbridge Area, prepared by Hart Crowser, Portland, Oregon, January 29, 1993.

Table 3

McCall Oil and Chemical Corporation
Ownership and Occupational History - McCall Site [a, b]

Year	Activity
1946	Flintkote buys land now occupied by McCall asphalt plant from Port of Portland (tax lot #96). Deed includes an easement for a railroad spur to be used by Port of Portland.
1952	Standard Oil distribution plant listed as occupant of 5500 NW Front Ave. (Tax lot 96 - present McCall asphalt plant).
1960	Douglas Oil Asphalt Plant listed as occupant of McCall asphalt terminal area (5500 NW Front Ave).
1962	Douglas Oil buys (tax lot 96) from Flintkote (Conoco apparently bought Douglas Oil in same year).
1966-1967	Current marine terminal site (part of tax lots 26, 24, and 15) filled with dredge spoils from the Willamette River. State of Oregon deeds new land to Port of Portland.
1974	McCall Marine Terminal installs large tanks and builds office building. Tank foundation created by filling with clean sand from Oregon Steel Mills property to meet construction specifications. Land is leased from the Port of Portland.
1982	McCall buys asphalt facility and underlying property (tax lot 96) from Douglas Oil in Sept., sells to Erro Enterprises (McCall Bros.) in December. Erro operates asphalt facility.
1992	Erro sells land and asphalt operation back to McCall. McCall continues to operate asphalt facility and marine terminal.

[a] Compiled from Multnomah County title records and city of Portland historical occupancy records.
[b] See Figures 2 and 5.

Table 4

McCall Oil & Chemical Corporation
McCall Tank Capacities and Contents

Tank No.	Capacity	Contents	Location
1	266,000 bbls	Asphalt	MT
2	280,000 bbls	Asphalt	MT
4	223,000 bbls	Asphalt	MT
5	648 bbls	Diesel/Bunker	MT
6	648 bbls	Diesel Bunker	MT
7	63,000 bbls	Diesel	MT
8	63,000 bbls	Diesel	MT
9	11,000 bbls	Bunker	MT
10	11,000 bbls	Marine Diesel Oil	MT
11	20,000-gallons	Slop Tank	MT
12	10,000-gallons	Slop Tank	MT
15	30,000 gallons	CSS1[a]	AP
16	20,000 gallons	Empty	AP
17	20,000 gallons	Empty[c]	AP
18	5,000 gallons	Extender Oil	AP
19	10,000 bbls	Asphalt[d]	AP
20	10,000 bbls	Asphalt	AP
21	10,000 bbls	Asphalt	AP
22	450 bbls	CSSI	AP
23	450 bbls	Slop Tank	AP
24	2,000 bbls	Asphalt	AP
25	2,000 bbls	Asphalt	AP
26	2,000 bbls	Asphalt	AP
27	2,000 bbls	Asphalt	AP
28	240 bbls	Boiler Fuel	AP
29	11,500 gallons	Antistrip	AP

NOTE: MT = Marine Terminal.
AP = Asphalt Plant.
bbls = barrels (1 barrel = 42 gallons).

[a] CSS1 is emulsified asphalt diluted with water.
[b] Latex is used to rubberize asphalt (70% latex, and 30% water).
[c] Tank removed 1998.
[d] Contents of tanks T-19 through T-29 vary with consumer demands and shipment scheduling; these tanks contain different grades of emulsion-based asphalt, asphalt flux, and paving-grade asphalt.
[e] This table was in the 1994 Preliminary Assessment and has been revised to reflect current conditions.

Table 5

McCall Oil & Chemical Corporation
Summary of Historical Spill Releases – McCall

Spill No.	Dates	Material Released	Location	
1	1955-80	Medium cure (MC) products (containing kerosene distillates); Rapid cure (RC) products (containing petroleum naphthalene); stove oil; all used to manufacture asphalt cold-patch.	Douglas Asphalt Plant	Approximately 4 or 5 spill incidents involving 4,000 to 10,000 gallons per incident occurred in this area prior to the construction of the lube oil tank farm in 1982. Typically, the spilled product was recovered to the extent practicable, and the waste materials would be collected in 55-gallon metal drums and sent to St. John's landfill.
2	Mid-1960's	MC-250; MC-products contain kerosene distillates; MC-250 is 25% stove oil and 75% paving-grade asphalt.	Douglas Asphalt Plant	Operator error during the routine transfer of MC-250 resulted in the release of approximately 8,000 to 10,000 gallons of MC-250 into the aboveground storage tank containment area at the Douglas MC plant. The MC-250 remained a homogeneous mixture as it quickly cooled and hardened. The usable material was recovered using jackhammers and shovels. Unusable spilled material was sent to the St. John's Landfill.
3	Mid-1970's	Oil and water	Marine Terminal Slop Tank	The slop tank valve was inadvertently left open and an unknown quantity of oil and water was released into the Willamette River.
4	1982	Lube oil	McCall Lube Oil Plant	The lube oil plant was constructed in 1982. During construction, a lube oil spill occurred resulting in the release of an unknown quantity of lube oil into the aboveground storage tank area. Lube oil was recovered to the extent practical using a vacuum truck.
5	1955-80	Re-refined oil	Marine Terminal Tanks 10 and 7	The re-refined oil line between tanks 7 and 10 in the McCall Terminal leaked as a hose was disconnected from a product-transfer truck resulting in the release of a small quantity (<25 gallons) of oil onto the surrounding soil. All visibly stained soil was excavated and disposed in an off-site landfill (e.g. Hillsboro or St. John's). The oil was nearly solid at ambient temperature.

Table 5

McCall Oil & Chemical Corporation
Summary of Historical Spill Releases – McCall

Spill No.	Dates	Material Released	Location	
6	Mid-1970's	Asphalt	Marine Dock	
7	Early-1980's	Bunker Fuel	Marine Terminal Tank 6	The bunker fuel tank (Tank 6) at the McCall Terminal was overfilled resulting in the release of approximately 100 gallons of bunker fuel onto the surrounding soil. The spill was immediately cleaned up and all visibly stained soil was excavated and disposed at Hillsboro landfill.
8	1984	Black Oil (#6 fuel oil; marine fuel or industrial fuel oil)	Marine Terminal Tank 20	Approximately 800 barrels of bunker fuel was released at the McCall asphalt plant due to a tank manhole cover left open during tank filling operations. The Oregon DEQ was notified and cleanup operation were conducted by Environmental Pacific.
9	1985	Caustic soda	Asphalt Plant	Tank 10 at the former loading rack (currently the asphalt loading rack) contained caustic soda. A tank overfill resulted in the release of approximately 60 gallons of caustic soda.
10	1989	Oil and water	Marine Terminal Slop Tank	The contents of the slop tank overflowed and an unknown quantity of oil and water was released onto the ground. Visibly impacted soils were removed immediately following the incident.
11	1989	Asphalt	Asphalt Plant Tank 24	Approximately 200 gallons of asphalt were inadvertently released from Tank 24. The spilled asphalt was collected using jackhammers and shovels and disposed of at an off-site landfill. Cleanup conducted by NW Field Services.
12	Unknown	Asphalt flux	Flintkote	Small shipments (i.e., 1-2 truckloads) of asphalt flux overfilled on several occasions. The quantity is estimated to be small, but occurred periodically. The material was cleaned up following each incident.

Table 5

McCall Oil & Chemical Corporation
Summary of Historical Spill Releases – McCall

Spill No.	Dates	Material Released	Location	
13	1991	Asphalt	Marine Dock	A hose burst during asphalt loading operations at the new marine dock resulting in the release of an unknown quantity of asphalt into the river.
14	1983	Water and emulsified asphalt	Marine Terminal	Emulsified asphalt was sprayed onto the soil berm surrounding the aboveground storage tank farm at the McCall Oil terminal to prevent berm erosion. Following the application of asphalt, rain ensued prior to the asphalt hardening, resulting in storm water discharge containing trace amounts of asphalt.
15	1991	Bunker Fuel	Asphalt Plant Railcar Loading Area	A railcar tank bleeder-valve handle was inadvertently opened during product transfer operations and approximately 20 gallons of bunker fuel was released onto the surrounding soil during a period of heavy rainfall. Absorbent pads were immediately placed on the standing water and soil impacted with bunker fuel. No subsequent soil excavation was required.
16	1975-82	Diesel fuel	Marine Terminal	Two separate spills of diesel fuel from Tank 12 occurred during this period. Approximately 50 gallons of diesel fuel were released during each incident. While skimming the oil water separator, the skimmer was left unattended and overfilled a tank.
17	10/13/98	Diesel Fuel	Oil Water Separator	Diesel Fuel Spill OERS No. 98-2471. Temporary blockage or outlet for new separator resulted in light sheen on river. Estimate less than 2 gallons diesel.
18	11/20/99	Bunker Fuel	Rail tank car	Rail tank car overflow during offloading. Ross Environmental removed 11 drums soil and ballast. Estimated 85 gallons released.

Table 5

McCall Oil & Chemical Corporation
Summary of Historical Spill Releases – McCall

Spill No.	Dates	Material Released	Location	
19	7/16/95	RFO Bunker Blend	Marine Terminal[1]	A flange gasket cracked and split, allowing oil to seep by it under the pressure of the positive displacement pump. Estimated 50 gallons released and recovered.
20	3/21/96	Naphtha Solvent	Rail Tank Car[1]	A gasket leaked while unloading a railcar. Salvaged product was pumped into recovered drums. Estimated 40 lbs released and recovered.
21	1/12/90	Reclaimer motor oil	Lube tank farm area[1]	A camlock fitting came loose during delivery pump off. Oil absorbent applied immediately. NW Field Services vacuumed standing oil, dug out oil, stained fill/absorbent. Estimated 200 gallons spilled onto area paved with asphalt and recovered.
22	8/10/90	Asphalt Mix Oil	Asphalt Plant/NW Front Avenue[1]	Spill occurred as customer truck departed the facility. Product drained into storm drain on Front Avenue in sufficient volume to react with storm water and boil over.

[1] The locations of Spill Nos. 19 through 22 are being added to Figure 7 and the revised Figure will be sent out as a report supplement.

Table 6

McCall Oil & Chemical Corporation
Physical Properties of Asphalt/Heavy Oil Products[a]

Product	Flash Point (COC) EF	Absolute Viscosity at 140 EF (poises)		Kinematic Viscosity at 275 EF (cSt)		Condition at Ambient Temperature
		Min	Max	Min	Max	
AR-2000W	425	1,500	2,500	200	NA[b]	Solid
PBA-1	450	2,500	5,000	275	NA	Solid
AC-10	425	800	1,200	150	NA	Solid
AR-4000W	440	2,500	5,000	275	NA	Solid
PBA-2	450	2,500	6,000	275	NA	Solid
PBA-3	450	3,000	NA	275	NA	Solid
AC-15	435	1,200	1,800	175	NA	Solid
AR-4000	440	3,000	5,000	275	NA	Solid
AC-20	450	1,600	2,400	210	NA	Solid
AC-20R	450	1,600	2,400	325	NA	Solid
PBA-6	450	5,000	NA	275	NA	Solid
PBA-4	450	NA	14,000	350	NA	Solid
PBA-5	450	4,000	NA	400	NA	Solid
CSS-1	NA[b]	20[c]	100[c]	NA	NA	Liquid
CSS-1h	NA[b]	20[c]	100[c]	NA	NA	Liquid
Diesel	150-160	2.4	NA	NA	NA	Liquid
Bunker C	>220	220-400	NA	NA	NA	

NOTE: NA = not available.
COC = Cleveland Open Cup.
EF = degrees Fahrenheit.

[a] Minimum materials specifications derived from AASHTO, 1986, ODOT, 1989 and 1994, USFHA, 1985, and WSDOT, 1984.

[b] Not applicable.

[c] Saybolt Viscosity at 77 EF.

Table 7

Great Western Chemical Corporation [a, b] Ownership and Occupational History - GWCC Site

Year	Activity
1946	Flintkote buys land from Port of Portland (Tax lot #17).
1947	Flintkote begins asphalt shingle manufacturing operations (5700 NW Front Ave.).
1982	GWC Properties, Inc. buys land from Flintkote.
1983	Chemax facility constructed at old Flintkote factory.
1984	Chemax facility begins operations; Portland Branch begins operations in adjacent facility later in the year.
1993	Great Western Chemical (Portland Branch) is listed as the occupant for 5540 NW Front (this is the first listing for this address). Chemax still listed for 5700 NW Front.

[a] Compiled from Multnomah County ownership records and city of Portland occupancy records.
[b] See Figures 2 and 5.

Table 8A

Great Western Chemical Corporation
Tank Contents and Capacities – South Plant Operations

Tank Number	Capacity (gallons)	Contents
1	20,000	Ethylene glycol
2	20,000	Solvent 350B
3	20,000	Propyl Alcohol N
4	20,000	IPA 99%
5	20,000	Xylene
6	20,000	Water
7	20,000	Special Naphtha Light (aliphatic)
8	20,000	Water
9	10,000	Methylene Chloride
10	10,000	Calcium chloride
11	10,000	N-Propyl Acetate
12	10,000	Toluene
13	10,000	Propylene glycol
14	10,000	Methyl Ethyl Ketone
15	10,000	Propyl Alochol N
16	10,000	Toluene
17	10,000	Methanol
18	10,000	Parasolv 10C-190
19	30,000	Solvent 350B
20	4,000	Tanks removed
21	4,000	Tanks removed
22	4,000	Tanks removed
23	4,000	Tanks removed
24	4,000	Tanks removed
25	4,000	Tanks removed
26	4,000	Blending tank for IPA (80/90%)
A1	6,000	Muriatic acid (HCl)
A2	6,000	Phosphoric acid (75%, technical)
A3	15,000	Nitric acid (degree 42, HNO3)
A4	15,000	Sulfuric acid (H2SO4)
A5	15,000	Sulfuric acid (H2SO4)
A6	20,000	Sulfuric acid (H2SO4)
A7	20,000	Sulfuric acid (H2SO4)
A8	20,000	Sulfuric acid (H2SO4)
A9	20,000	Cutting and mixing tank
NT	11,000	Water
V1	2,000	Tanks removed
V2	2,000	Tanks removed
AQ1	13,000	Anthraquinone
AQ2	13,000	Anthraquinone
AQ3	16,000	Anthraquinone

NOTE: This table was in the 1994 Preliminary Assessment and has been revised to show current conditions.

Table 8B

Great Western Chemical Corporation
Tank Contents and Capacities
North Plant Operations

Tank Number	Item #'s Calgon/Oracle	Capacity Gal/Inch
Empty		5000 gl
Sodium Hypochlorite	106469 #1	5000 gl 30.5 gl/inch
Sodium Hypochlorite	106469 #2	5000 gl 30.5 gl/inch
Empty		9500 gl
E-2271	006H3308	9500 gl 50 gl/inch
Pol-EZ 2706	006F2408	9500 gl 50 gl/inch
Pol EZ 7736	006F1908	9500 gl 50 gl/inch
Caustic Potash 45%	101827	8200 gl 50 gl/inch
Caustic Soda 50% Std	100439	11,100 gl 69 gl/inch
Sodium Chlorite Tank #1	118340	10,000 gl gauge on tank
Sodium Chlorite Tank #2	118340	10,000 gl gauge on tank
Sodium Chlorite Tank #3	118340	10,000 gl gauge on tank
Phosphoric Acid 75%	115961 119597N	10,000 gl 50 gl/inch
Lubricoat 629	113880	6200 gl 36 gl/inch

Table 9

Great Western Chemical Corporation
Summary of Historical Spill Releases - GWCC[a]

Number	Dates	Material Released	Location (see Figure 12)	Description
1	1988 or 1989?	H_2SO_4	On blacktop (drumming area)	A drum of H_2SO_4 split open. Spill was diked and cleaned up with sorbent material.
2	?	CO630 (surfactant)	Railcar loading area	Release during tank car offloading --cleaned up,
3	?	H_2SO_4	Acid tank farm	Valve apparently left open; quantity unknown, but spill contained within bermed area.
4	1987 or 1988?	H_2SO_4	Acid tank farm	Bottom of tank corroded, approximately 20,000 gallons spilled into bermed area. Acid was pumped into trucks and tanks were repaired and raised onto pads.
5	?	Rinsate	Drum rinse area	Rinsate from drum rinsing operations occasionally ran onto dredge spoils. Mostly acid drums, possibly some solvent drums.
6	?	Calgon Cat-Floc	Technical Center railcar loading area	Several incidental spills, cleaned up and put into totes.
7	1990	1,1,9-Triethylamine	Portland Branch Railcar loading area	Railcar leaked over the weekend in the loading area. Soil was tested by Hahn & Associates. No further action required. No detections. Amount of spill was below the reportable quantity limit.
8	1984 (?) - 1988	$CuSO_4$	$CUSO_4$ containment structure	Crack in the concrete $CuSO_4$ containment structure was discovered during decommissioning activities. Soil was overexcavated beneath the structure and soil and concrete were disposed of off-site at TSDF.
9	1984 (?) - 1989	CCA	CCA Process Area	A prior release was discovered in 1992 during excavation in the former CCA Process Area. Soil and concrete were excavated and confirmation samples were collected from the excavation. Concrete and soil were disposed of off-site at TSDF. Groundwater monitoring continues.
10	1/21/99	Sodium hydroxide (caustic soda)	Storage yard[1]	Tote bin of caustic soda fell from forklift. Contents released onto asphalt pavement drainage ditch. Spill diked and fully contained; no release to land or water. All materials cleaned up. Estimated 2,000 lbs. of combined material and absorbent material.
11	4/28/93	Diesel Fuel	Parking lot[1]	A distributor was operating a truck and backed over a stake on the RR grade, puncturing the diesel tank. Estimated 30 gallons was spilled onto asphalt-paved parking area. All materials cleaned up – no release to land or water.

Table 9

Great Western Chemical Corporation
Summary of Historical Spill Releases - GWCC [a]

Number	Dates	Material Released	Location (see Figure 12)	Description
12	3/26/96	Sulfuric acid	Acid Loading rack[1]	A driver was filling his tanker truck with no gauges, resulting in an overflow of product. Estimated 150-200 gallons was spilled in contained area. All materials cleaned up -- no release to land or water.
13	6/24/99	Sulfuric acid	GWEM receiving dock[1]	Drum slipped from drum pick, dropping 12-18". Drum split open; 55 gallons of product splashed onto receiving dock. Spill cleaned -- no release to environment.
14	5/19/99	Sulfuric acid	GWEM warehouse[1]	Drum slipped off the drum pick while being lifted causing release of 500 gallons of product onto floor. Spill cleaned -- no release to environment.
15	4/26/00	Sulfuric acid	Tank Farm[1]	Contractor dropped pipe onto valve resulting in leakage of product onto graveled area. Foss Environmental excavated materials and performed confirmation sampling. Estimated release of 70 gallons.
16	8/5/98	Lacquer thinner	Warehouse	Forklift pierced bottom of drum resulting in release of approximately 25 gallons of product onto warehouse floor. Product was contained and absorbed. No release to the environment.
17	9/22/98	Sodium hypochloride	Warehouse[1]	A tote ruptured while being moved to the trailer. Approximately 220 gallons of product was spilled. Material was contained with absorbent. No release to the environment.
18	1/7/99	pH water	Storage yard[1]	A hose ruptured during pumpdown of one of the pH pumps. Unknown quantity ran into the asphalt trench. Drainage valves were closed -- no material reached the river. Ditch was hosed down, materials were pumped into a tote and returned to remediation tank.
19	3/1/99	Lubricoat	Tech Ctr. Loading Bay[1]	Tote overturned causing release of 200 gallons of product onto paved truck area. Sewer hole was covered immediately. Material was absorbed. No release to tank or water.

[1] The locations or spills 10 through 19 are being added to Figure 12 and the revised Figure will be sent out as a report supplement.

Table 11
Groundwater Quality Data Trends
McCall Oil/Great Western Chemical Company

Well	Date	Total TPH		VOCs			
		Diesel	Other	1,1-DCE	TCA	TCE	PCE
EX-1	09/08/1994	50 U	266	7	180	160	650
	12/30/1994	50 U	632	22	290	280	2000
	03/29/1995	50 U	454	5 U	310	400	2600
	07/14/1995	50 U	200 U	5 U	76	90	980
	05/01/1997	50 U	200 U	1.8	270	470	3600
	02/04/1999	100 U	924	50 U	130	250	3000
EX-2	09/08/1994	50 U	200 U				
	12/30/1994	50 U	441	5 U	5 U	5 U	5 U
	03/29/1995	50 U	398	5 U	5 U	5 U	5 U
	07/14/1995	50 U	885	5 U	5 U	5 U	5 U
	05/01/1997	519	200 U	0.5 U	0.5 U	0.5 U	0.5 U
	02/04/1999	10 U	569	0.5 U	0.5 U	0.5 U	0.5 U
EX-3	09/08/1994	50 U	200 U				
	12/30/1994	50 U	200 U	5 U	5 U	5 U	5 U
	03/29/1995	50 U	474	5 U	5 U	5 U	5 U
	07/14/1995	50 U	226	5 U	5 U	5 U	5 U
	05/01/1997	64	200 U	0.5 U	0.5 U	0.5 U	0.5 U
	02/04/1999	100 U	564	0.5 U	0.5 U	0.5 U	0.5 U
EX-4	09/08/1994	50 U	200 U				
(MW-2)	12/30/1994	1000 U	3840	5 U	5 U	5 U	5 U
	03/29/1995	2140	200 U	5 U	5 U	5 U	5 U
	07/14/1995	343	200 U	5 U	5 U	5 U	5 U
	05/01/1997	1310	200 U	0.5 U	0.5 U	0.5 U	0.5 U
	02/04/1999	100 U	787	0.5 U	0.5 U	0.5 U	0.5 U

Table 11
Groundwater Quality Data Trends
McCall Oil/Great Western Chemical Company

Well	Date	Total TPH		VOCs			
		Diesel	Other	1,1-DCE	TCA	TCE	PCE
EX-5	09/08/1994						
	12/30/1994	50 U	1400	5 U	5 U	5 U	5 U
	03/29/1995	50 U	767	5 U	5 U	5 U	5 U
	07/14/1995	1500	200 U	5 U	5 U	5 U	5 U
	05/01/1997	50 U	415	0.5 U	0.5 U	0.5 U	0.5 U
	02/04/1999	100 U	573	0.5 U	0.5 U	0.5 U	0.5 U
EX-6	09/08/1994						
	12/30/1994	50 U	851	5 U	5 U	5 U	5 U
	03/29/1995	50 U	1160	5 U	5 U	5 U	5 U
	07/14/1995	50 U	200 U	5 U	5 U	5 U	5 U
	05/01/1997	50 U	1450	1	0.5 U	2.6	0.7
	02/04/1999	100 U	1280	0.5 U	0.5 U	0.5 U	0.5 U
EX-7	09/08/1994						
	12/30/1994	50 U	200 U	5 U	5 U	5 U	5 U
	03/29/1995	50 U	200 U	5 U	5 U	5 U	5 U
	07/14/1995	50 U	200 U	5 U	5 U	5 U	5 U
	05/01/1997	50 U	200 U	0.5 U	0.5 U	0.5 U	0.5 U
	02/04/1999	100 U	250 U	0.5 U	0.5 U	0.5 U	0.5 U
MW-1	05/01/1997	319	200 U	0.9	8	28	110
	02/04/1999	100 U	250 U	0.5 U	0.5 U	0.5 U	1.7
MW-3	05/01/1997	1430	200 U	0.5 U	0.5 U	0.5 U	0.5 U
	02/04/1999	100 U	1190	0.5 U	0.5 U	0.5 U	0.5 U
MW-4	05/01/1997	312	200 U	0.5 U	0.5 U	8.1	11
	02/04/1999	100 U	716	0.5 U	0.5 U	2	2.5

Table 11
Groundwater Quality Data Trends
McCall Oil/Great Western Chemical Company

Well	Date	Total TPH		VOCs			
		Diesel	Other	1,1-DCE	TCA	TCE	PCE
MW-5	05/01/1997	204	200 U	0.5 U	0.5 U	0.5 U	0.5 U
	02/04/1999	100 U	391	0.5 U	0.5 U	0.5 U	0.5 U

Notes: U=Not detected at or above the method reporting limit.
Other=Lube oil or other petroleum hydrocarbon outside the typical range.
1,1-DCE=1,1=Dichloroethene
TCA=1,1,1-Trichloroethane
TCE=Trichloroethene
PCE=Tetrachloroethene

Table 12

McCall Oil/Great Western Chemical Company
Soil Analytical Results
Total Petroleum Hydrocarbons
USEPA Methods 3540/8015 Modified mg/Kg (ppm)

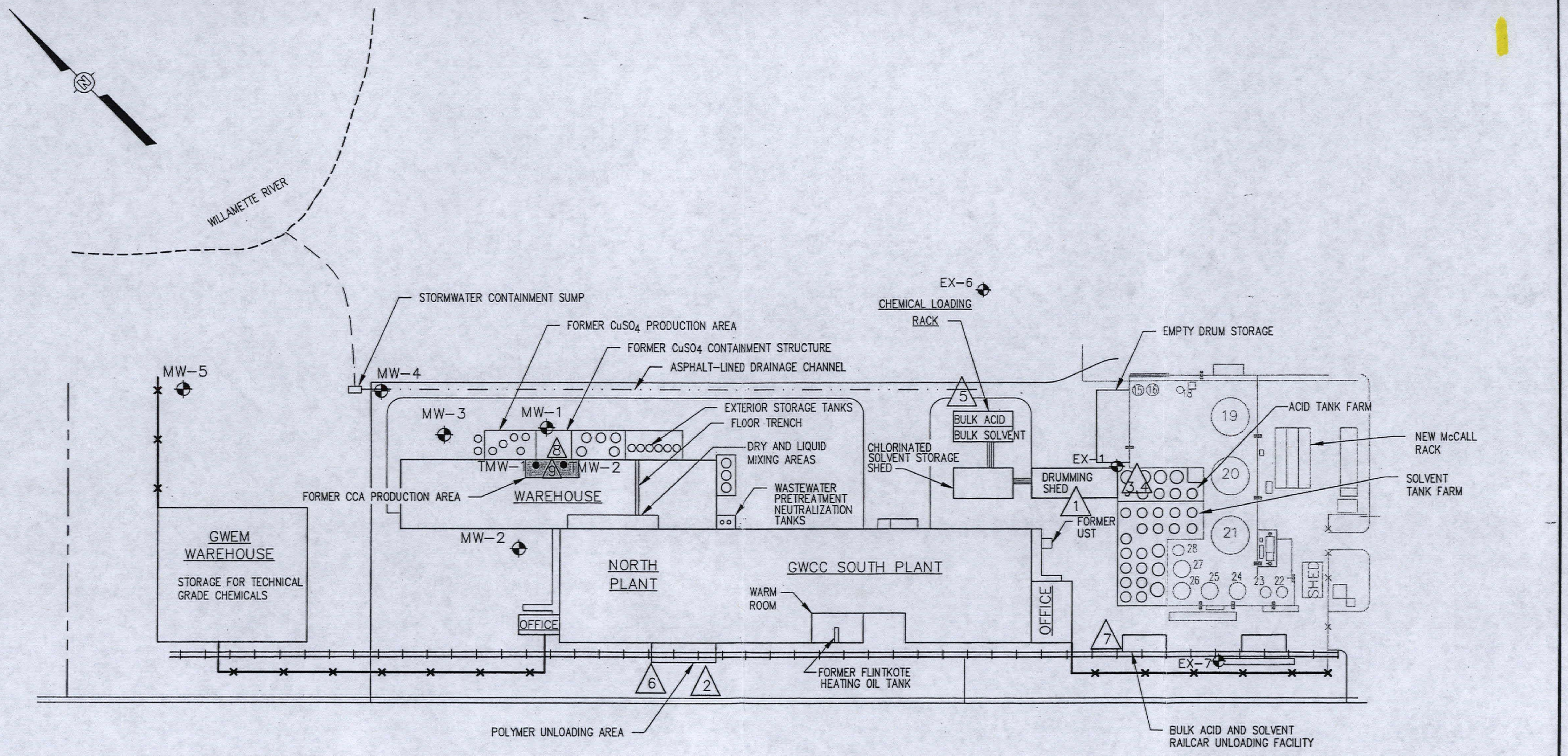
Boring	Sample Name	Depth Collected [a]	Gasoline	Mineral Spirits	Jet Fuel	Kerosene	Diesel	Other [b]
EX-1	EX-1-0994-01	5	ND	ND	ND	ND	ND	321
	EX1-0994-02	15.5	ND	ND	ND	ND	ND	ND
EX-2	EX2-0994-01	5	ND	ND	ND	ND	ND	55
	EX2-0994-02	18	ND	ND	ND	ND	ND	ND
EX-3	EX3-0994-01	5	ND	ND	ND	ND	ND	ND
	EX-3-0994-02	16.5	ND	ND	ND	ND	ND	ND
EX-5	EX-5-5'	5-6.5	ND	ND	ND	ND	ND	182
	EX-5-17'	17-18.5	ND	ND	ND	ND	ND	ND
EX-6	EX-6-4.5'	4.5-6.0	ND	ND	ND	ND	ND	28
	EX-6-13.5'	13.5-15.0	ND	ND	ND	ND	ND	4,400[c]
	EX-6-15'	15.0-16.5	ND	ND	ND	ND	ND	352
EX-7	EX-7-5'	4.0-5.5	ND	ND	ND	ND	ND	31
	EX-7-14.5'	14.5-16.0	ND	ND	ND	ND	ND	ND

[a] Feet below ground surface.

[b] Quantified using 30-weight motor oil as a standard.

[c] Result is from the analysis of a sample diluted 1:10.

[d] This information was derived from the First and Second Quarter Groundwater Monitoring Reports, November 14, 1994 and March 15, 1995, prepared for McCall Oil & Chemical Corporation and Great Western Chemical Company.



EXPLANATION

1 — APPROXIMATE LOCATION OF SPILL REFER TO TABLE 10 FOR SPILL DETAILS

MW-5 — MONITORING WELL LOCATION

TMW-1 — TEMPORARY MONITORING WELL LOCATION

T — DISCHARGE OUTFALL

— — — SUBGRADE STORMWATER PIPING

SCALE

0 100 200 FEET

IT CORPORATION
IT CORPORATION
15055 SW Sequoia Parkway
Suite 140
Portland, Oregon 97224
(503)624-7200 Fax(503)620-7658

FIGURE 12
GREAT WESTERN CHEMICAL COMPANY
HISTORICAL RELEASE LOCATIONS
REMEDIAL INVESTIGATION
McCALL OIL AND CHEMICAL CORPORATION
PORTLAND, OREGON

OFFICE	DRAWN BY	CHECKED BY	APPROVED BY	DRAWING NUMBER
Portland	R. Bricker 5-22-00		JCR 6/14/00	807595-B7

Jun 13, 2000 - 6:53pm
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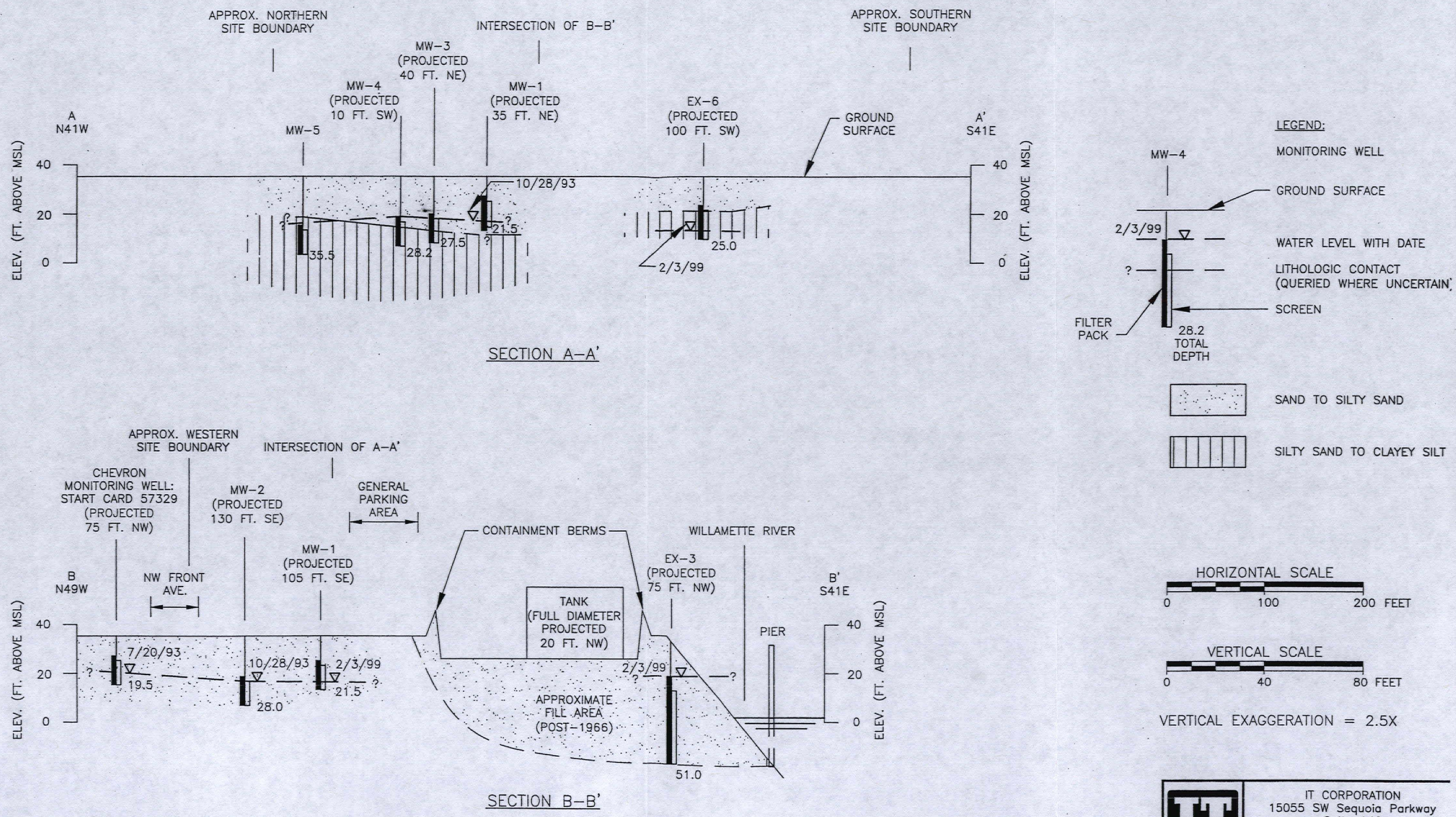

OFFICE	DRAWN BY	CHECKED BY	APPROVED BY	DRAWING NUMBER
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Jun 13, 2000 – 6:54pm
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IT CORPORATION

IT CORPORATION
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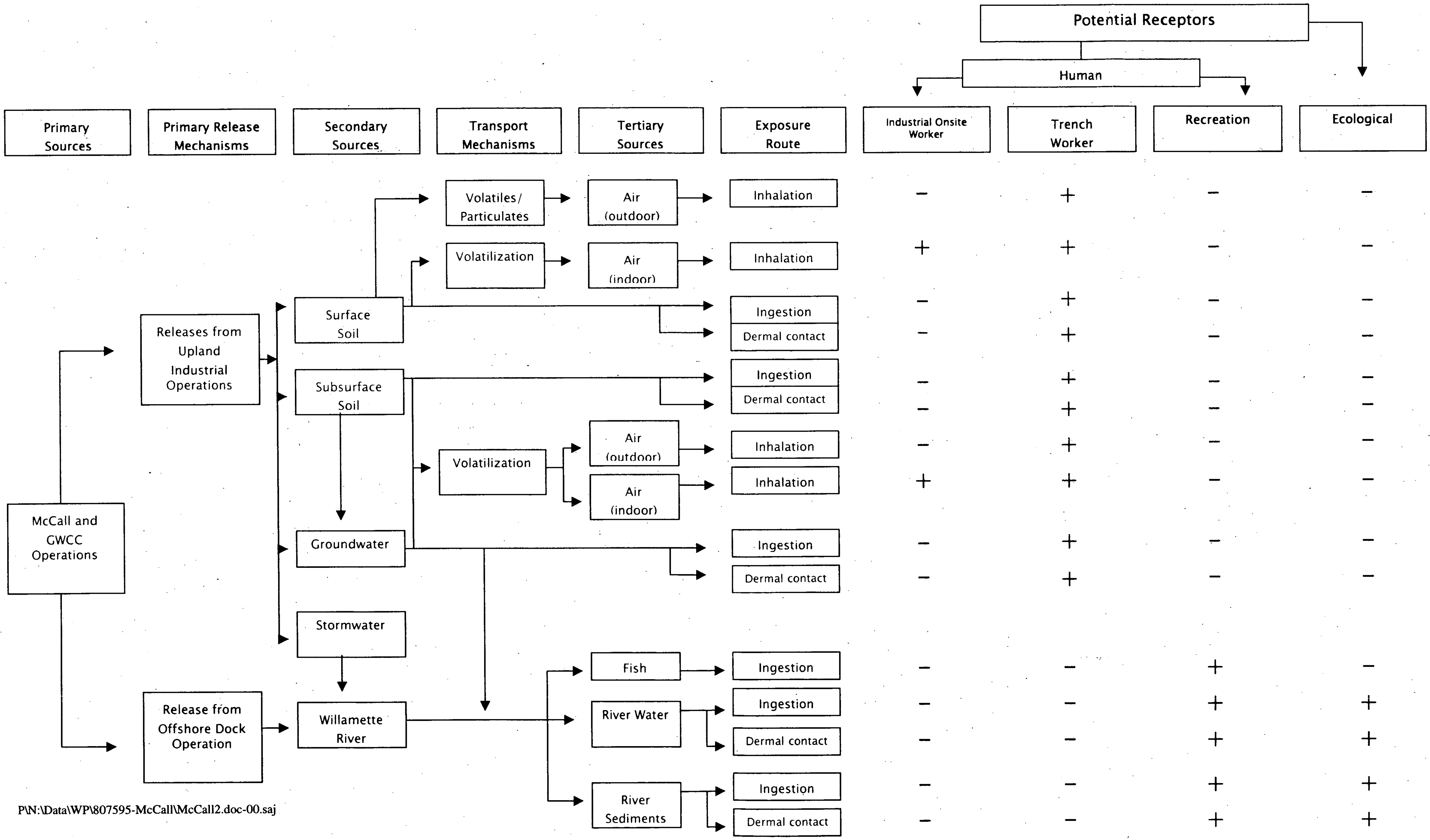
Suite 140
Portland, Oregon 97224
(503)624–7200 Fax(503)620–7658

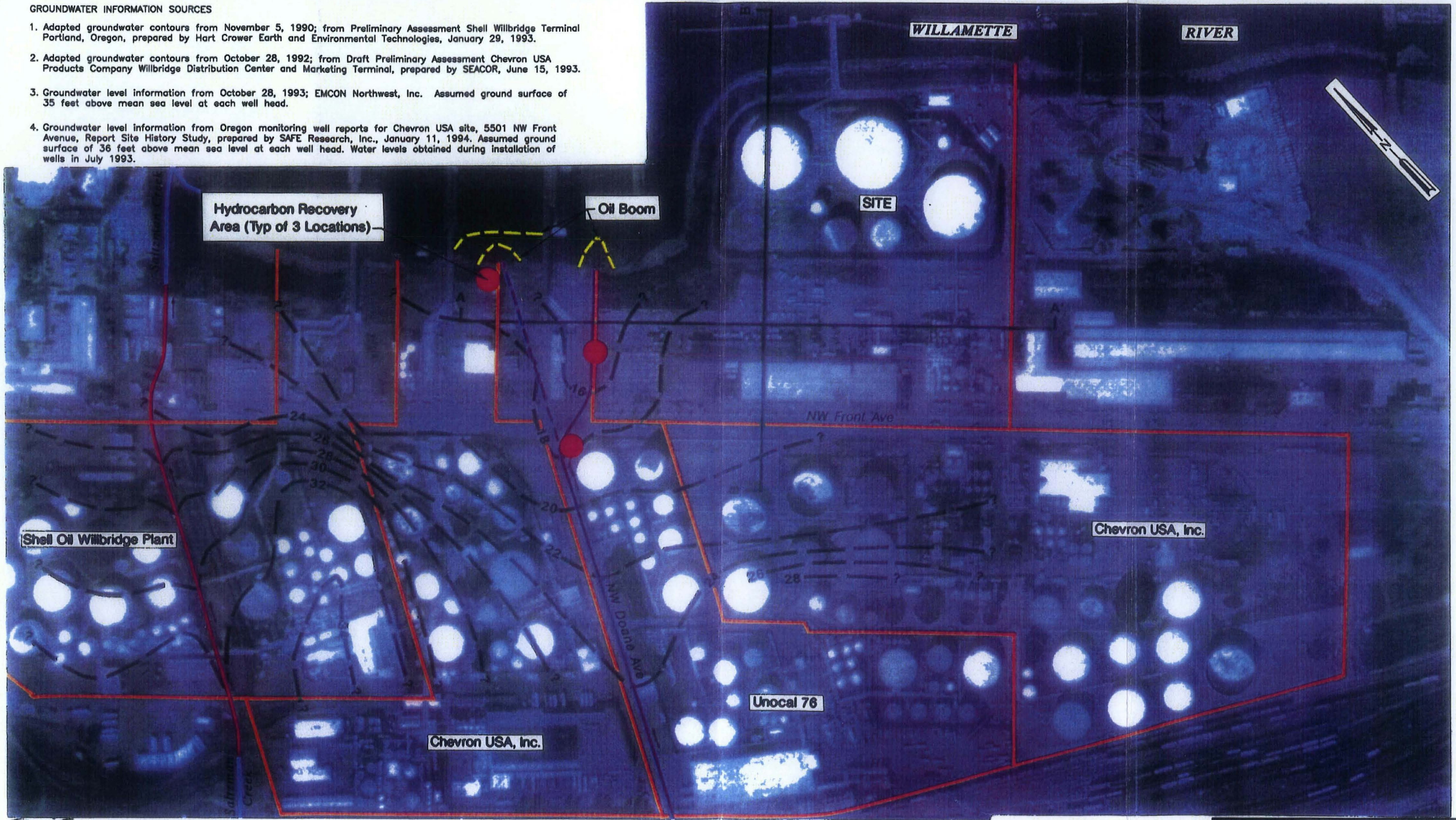
FIGURE 11
CROSS SECTIONS A–A' & B–B'
REMEDIAL INVESTIGATION
McCALL OIL AND CHEMICAL CORPORATION
PORTLAND, OREGON

FIGURE 10
MCCALL OIL & CHEMICAL CONCEPTUAL SITE MODEL



GROUNDWATER INFORMATION SOURCES

1. Adapted groundwater contours from November 5, 1990; from Preliminary Assessment Shell Willbridge Terminal Portland, Oregon, prepared by Hart Crower Earth and Environmental Technologies, January 29, 1993.
2. Adapted groundwater contours from October 28, 1992; from Draft Preliminary Assessment Chevron USA Products Company Willbridge Distribution Center and Marketing Terminal, prepared by SEACOR, June 15, 1993.
3. Groundwater level information from October 28, 1993; EMCON Northwest, Inc. Assumed ground surface of 35 feet above mean sea level at each well head.
4. Groundwater level information from Oregon monitoring well reports for Chevron USA site, 5501 NW Front Avenue, Report Site History Study, prepared by SAFE Research, Inc., January 11, 1994. Assumed ground surface of 36 feet above mean sea level at each well head. Water levels obtained during installation of wells in July 1993.



EXPLANATION

22 — — —	Inferred poteniometric contour in feet above mean sea level
(red line)	Approximate facility property boundary
(blue line)	Storm sewer
(pink line)	Concrete flume
— — —	Abandoned storm sewer
A ⌊ ⌋ A'	Cross section location (see Figure 7)

0 300 600

SCALE IN FEET

IT CORPORATION
15055 SW Sequoia Parkway
Suite 140
Portland, Oregon 97224
(503)624-7200 Fax(503)620-7658

FIGURE 4

GENERALIZED AREA
REMEDIAL INVESTIGATION

McCALL OIL AND CHEMICAL CORPORATION
PORTLAND, OREGON

OFFICE	DRAWN BY	CHECKED BY	APPROVED BY	DRAWING NUMBER
Portland	R. Bricker 6-14-00		6/14/00	807595-B8

Jun 14, 2000 - 9:37am
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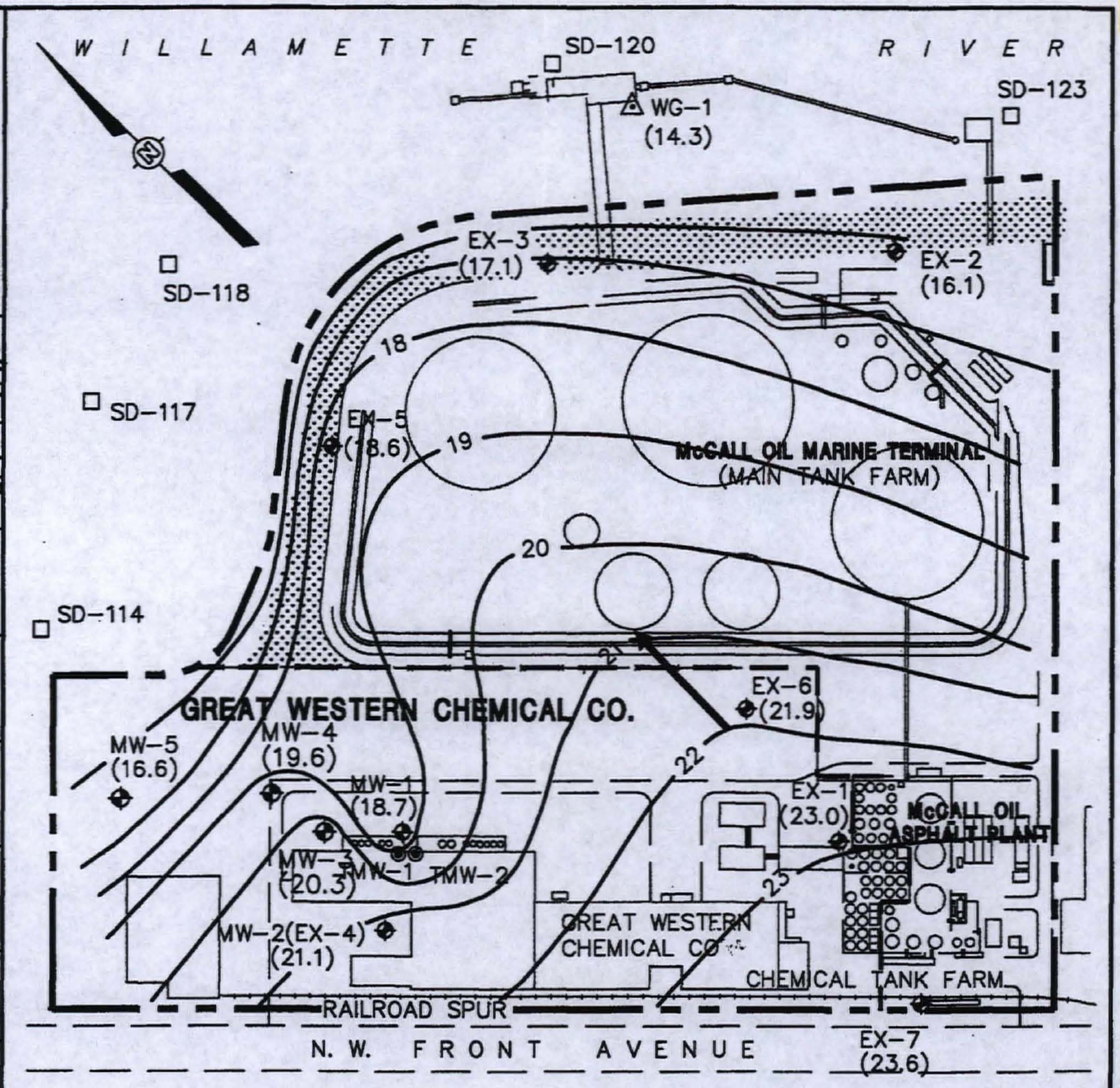

LEGEND:

— · · —	McCALL OIL/GREAT WESTERN CHEMICAL PLANT BOUNDARY
MW-5	MONITORING WELL
WG-1	WILLAMETTE RIVER GAUGE
(21.6)	GROUNDWATER ELEVATION (FT, MSL)
SD-114	SEDIMENT SAMPLE (WESTON, 1997)
←	GENERAL GROUNDWATER FLOW DIRECTION

SCALE
0 200 400 FEET

IT CORPORATION
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Suite 140
Portland, Oregon 97224
(503)624-7200 Fax(503)620-7658

FIGURE 9
WATER TABLE MAP—FEBRUARY 3, 1999
REMEDIAL INVESTIGATION
McCALL OIL AND CHEMICAL CORPORATION
PORTLAND, OREGON

OFFICE	DRAWN BY	CHECKED BY	APPROVED BY	DRAWING NUMBER
Portland	R. Bricker 6-13-00		JRC 6/14/00	807595-A2

Jun 14, 2000 - 4:03pm
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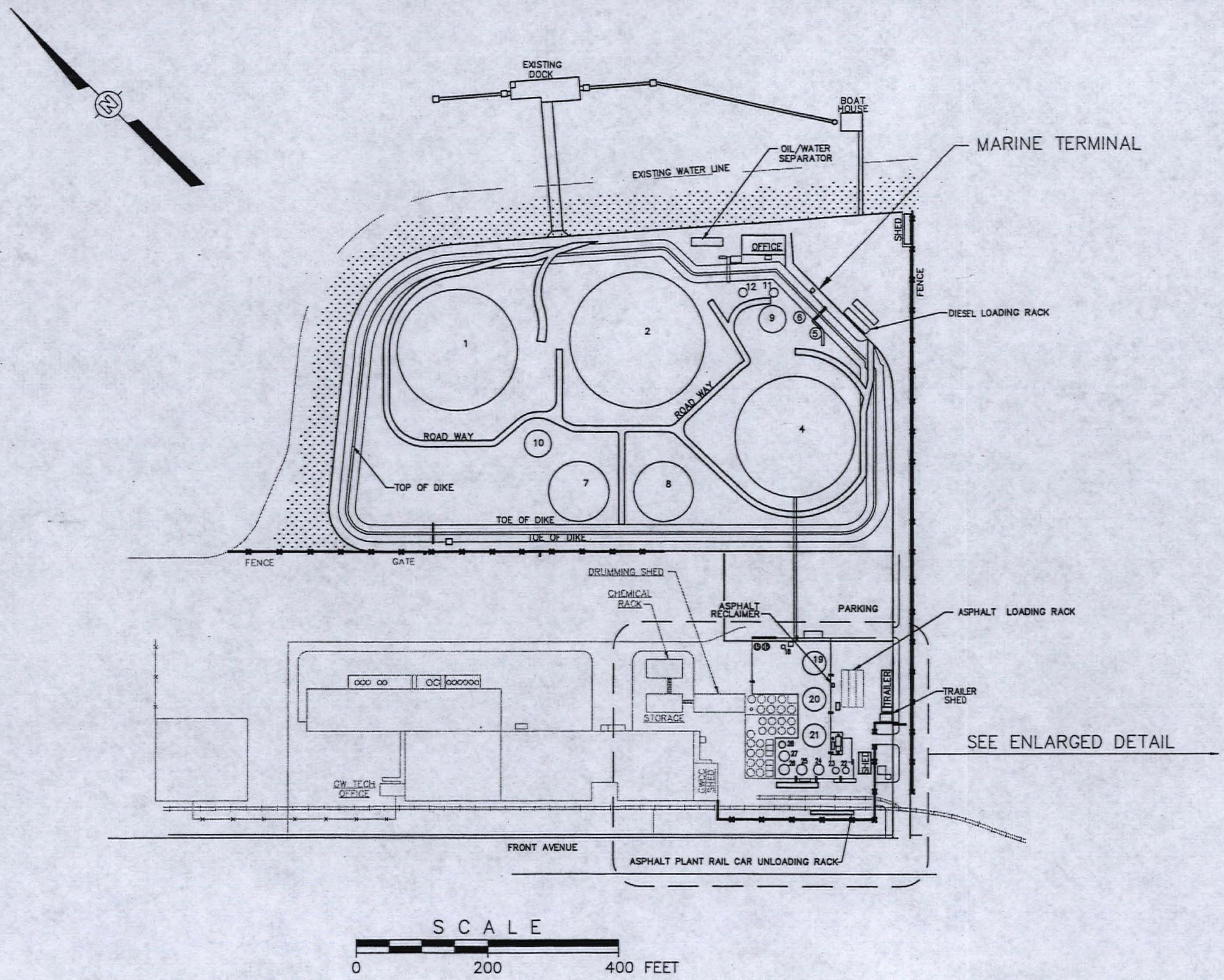

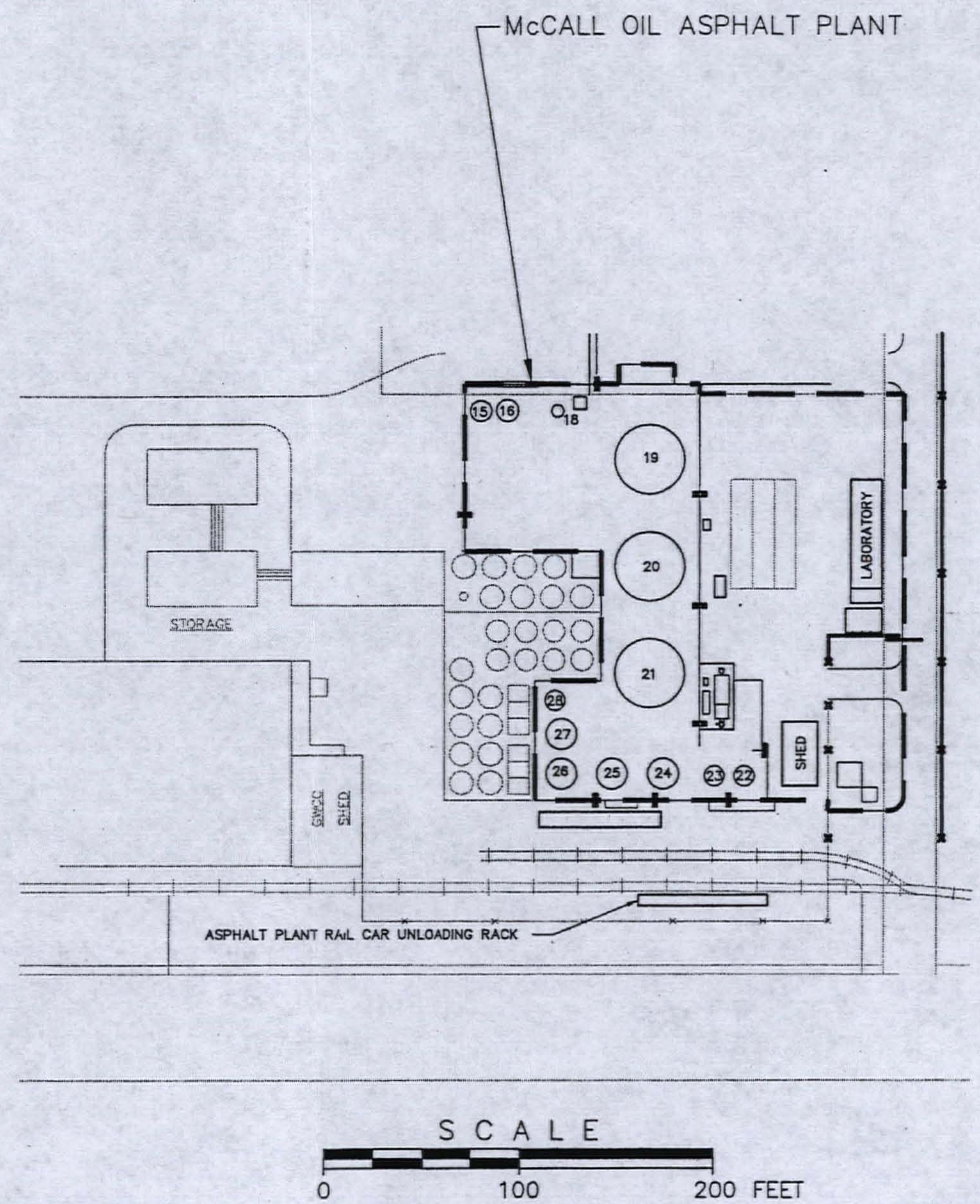

LEGEND:
1 TANK NUMBER
(CONTENTS ARE SUMMARIZED ON TABLE 4.)

NOTE:
MAP MODIFIED FROM McCALL OIL, EVACUATION PLAN, PORTLAND MARINE TERMINAL, "C-1", 8-26-93, PROJECT 1923 (1923.01\C01B.DWG)

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IT CORPORATION
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Suite 140
Portland, Oregon 97224
(503)624-7200 Fax(503)620-7658

FIGURE 5
McCALL OIL FACILITIES
REMEDIAL INVESTIGATION
McCALL OIL AND CHEMICAL CORPORATION
PORTLAND, OREGON

OFFICE	DRAWN BY	CHECKED BY	APPROVED BY	DRAWING NUMBER
Portland	R. Bricker 6-16-00		JRE 6/14/00	807595-B4

Jun 13, 2000 - 6:46pm
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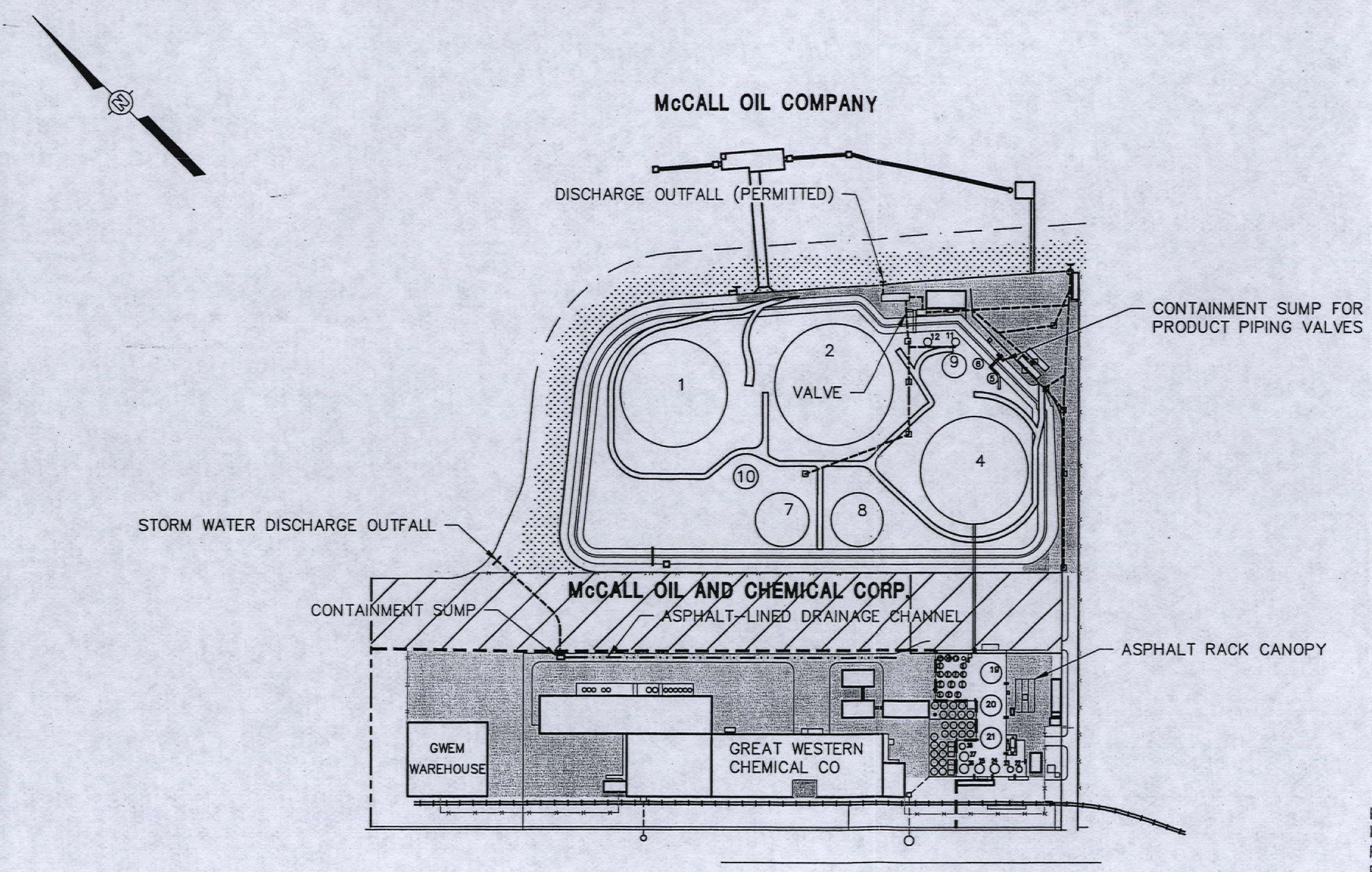

EXPLANATION

- IMPERVIOUS AREAS (ASPHALT-PAVED)
- CATCH BASIN
- MANHOLES
- DRAINAGE CHANNEL
- SUBGRADE PIPING (STORM WATER)
- DISCHARGE OUTFALL
- McCALL OIL/GREAT WESTERN CHEMICAL COMPANY PROPERTY BOUNDARY
- STORMWATER RUNOFF TO McCALL OIL WATER SEPARATOR NPDES DISCHARGE

NOTE:
MAP MODIFIED FROM McCALL OIL, EVACUATION PLAN, PORTLAND MARINE TERMINAL, "C-1", 8-26-93, PROJECT 1923 (1923.01\C01B.DWG)

SCALE
0 200 400 FEET

IT CORPORATION
IT CORPORATION
15055 SW Sequoia Parkway
Suite 140
Portland, Oregon 97224
(503)624-7200 Fax(503)620-7658

FIGURE 6
IMPERVIOUS AREAS AND STORM WATER ROUTING
REMEDIAL INVESTIGATION
McCALL OIL AND CHEMICAL CORPORATION
PORTLAND, OREGON

OFFICE	DRAWN BY	CHECKED BY	APPROVED BY	DRAWING NUMBER
Portland	R. Bricker 6-13-00		JTC 6/14/00	807595-B3

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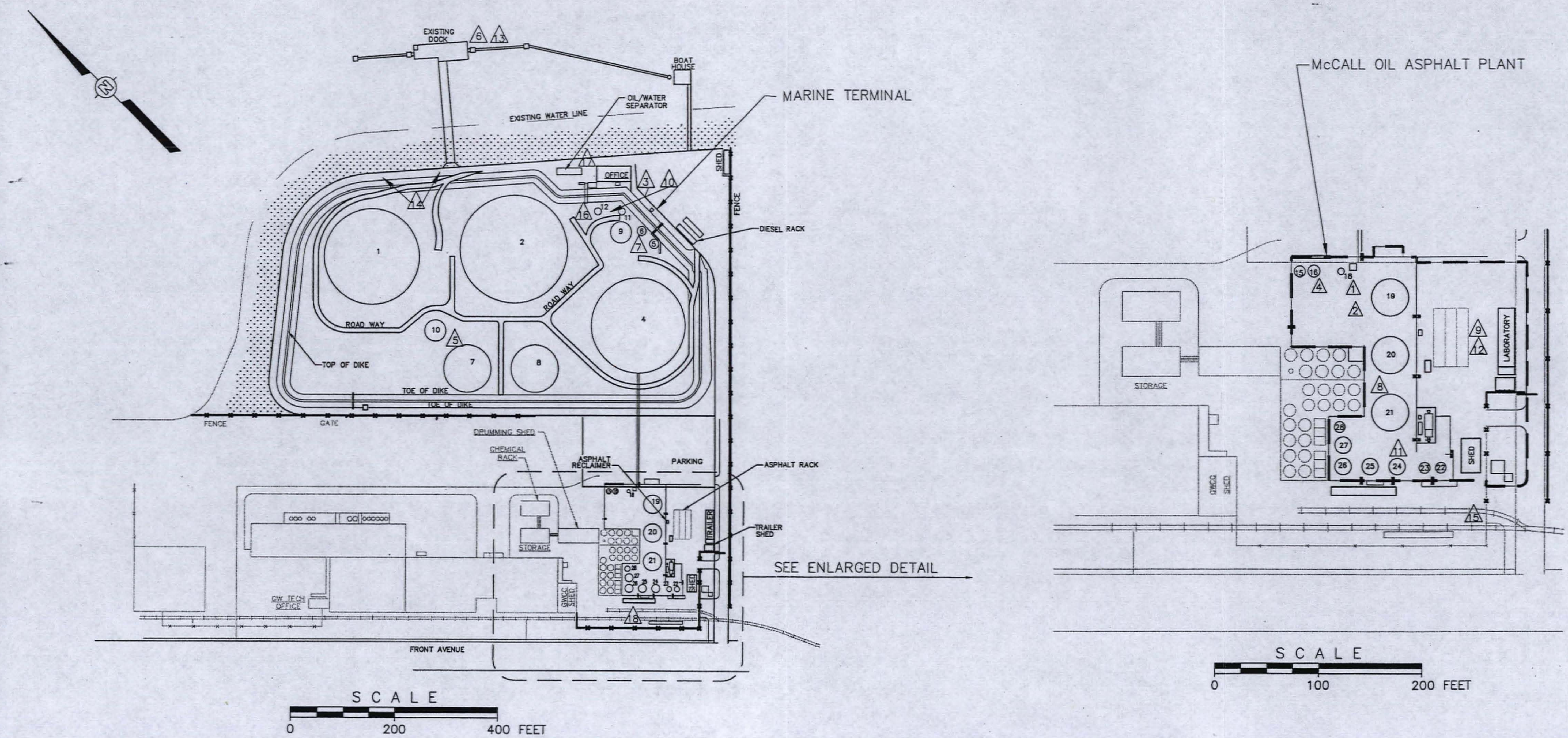

LEGEND:
APPROXIMATE LOCATION OF RELEASE (REFER TO TABLE 5 FOR SUMMARY.)

NOTE:
MAP MODIFIED FROM McCALL OIL, EVACUATION PLAN, PORTLAND MARINE TERMINAL, "C-1", 8-26-93, PROJECT 1923 (1923.01\C01B.DWG)

OFFICE	DRAWN BY	CHECKED BY	APPROVED BY	DRAWING NUMBER
Portland	R. Bricker 5-22-00		JCR 6/14/00	807595-B5

Jun 13, 2000 - 6:48pm
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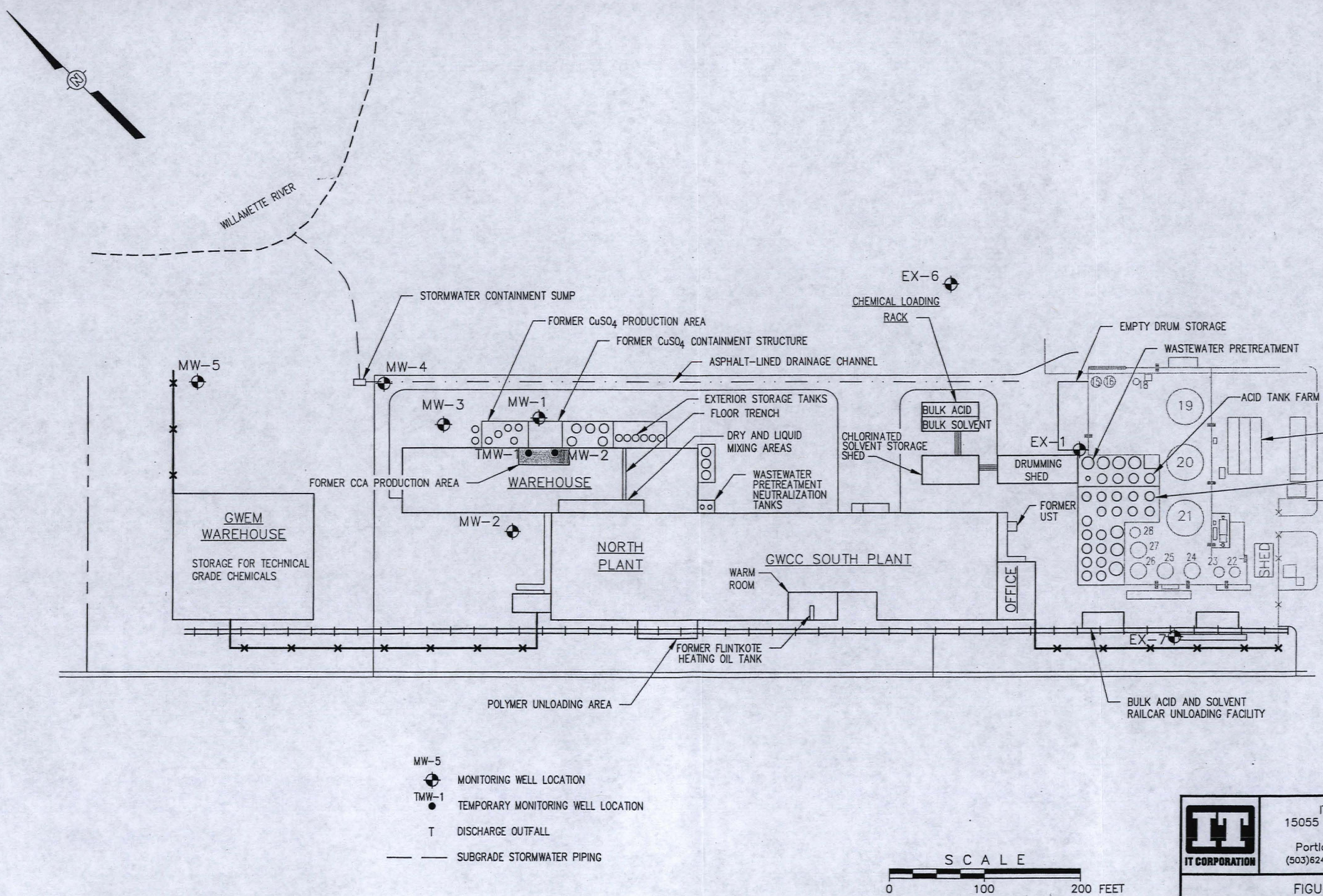
IT CORPORATION
IT CORPORATION
15055 SW Sequoia Parkway
Suite 140
Portland, Oregon 97224
(503)624-7200 Fax(503)620-7658

FIGURE 7
McCALL OIL HISTORICAL RELEASE LOCATIONS
REMEDIAL INVESTIGATION
McCALL OIL AND CHEMICAL CORPORATION
PORTLAND, OREGON



IT CORPORATION
15055 SW Sequoia Parkway
Suite 140
Portland, Oregon 97224
(503)624-7200 Fax(503)620-7658

FIGURE 8

GREAT WESTERN FACILITIES MAP
REMEDIAL INVESTIGATION
McCALL OIL AND CHEMICAL CORPORATION
PORTLAND, OREGON

OFFICE	DRAWN BY	CHECKED BY	APPROVED BY	DRAWING NUMBER
Portland	R. Bricker 6-13-00		JPR 6/14/00	807595-B6

Jun 13, 2000 - 6:52pm
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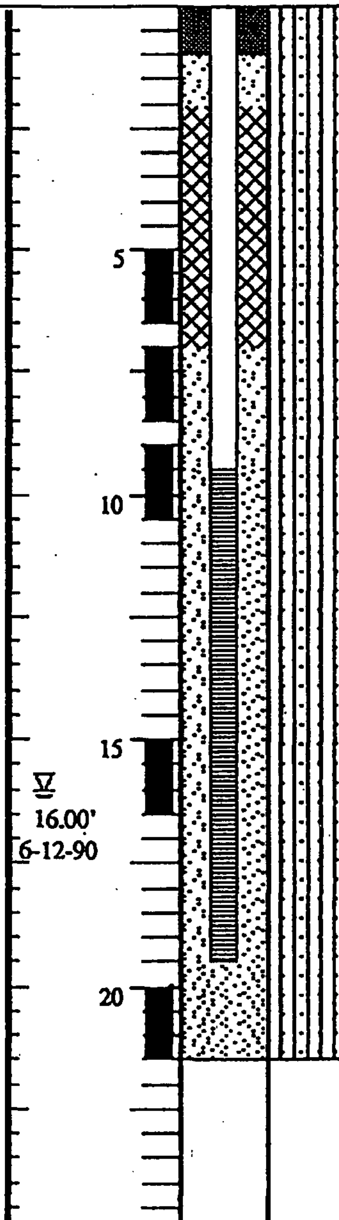
LOG OF EXPLORATORY BORING

PROJECT NAME	CHEMAX	BORING NO.	MW-1
LOCATION	Portland, Oregon	PAGE	1 OF 1
DRILLED BY	GeoTech Explorations	REFERENCE ELEV.	'±
DRILL METHOD	H.S. Auger	TOTAL DEPTH	21.50'
LOGGED BY	A. Coates	DATE COMPLETED	6/13/90

SAMPLE NUMBER (SAMPLE TYPE)	RECOVERY PERCENT (%)	BLOW COUNTS (N COMP)	GROUND WATER LEVELS	DEPTH IN FT.	SAMPLES	WELL DETAILS	LITHO-LOGIC COLUMN	LITHOLOGIC DESCRIPTION
								0-21.5' SAND (SM), medium brown, trace white, 30% non-plastic fines, 70% fine sand, trace fine subrounded to subangular gravel, loose to compact, moist to wet.
#1 (SS)	93%	2-3-4 (7)		5				
#2 (SS)	86%	4-2-3 (5)						@ 7-8 feet, trace fine to coarse subrounded to subangular gravel.
#3 (SS)	100%	2-3-3 (6)		10				
#4 (SS)	100%	5-6-11 (17)	∇ 16.00' 6-12-90	15				
#5 (SS)	80%	2-2-2 (4)		20				
				25				Bottom of borehole at 21.5 feet.



REMARKS
(SS) = Split spoon sample. Sample at depth 5-6.5 feet was named CHEM-2A, sample at depth 15-16 feet was named CHEM-2B.

LOG OF EXPLORATORY BORING

PROJECT NAME	CHEMAX	BORING NO.	MW- 2
LOCATION	Portland, Oregon	PAGE	1 OF 2
DRILLED BY	GeoTech Explorations	REFERENCE ELEV.	±
DRILL METHOD	Hollow Stem Auger	TOTAL DEPTH	28.00'
LOGGED BY	C. Hultgren	DATE COMPLETED	10/1/93

SAMPLE NUMBER SAMPLE TYPE		BLOW COUNTS	GROUND WATER LEVELS	DEPTH IN FEET	SAMPLES	WELL DETAILS	LITHO LOGIC COLUMN	LITHOLOGIC DESCRIPTION
								0-1.5 feet: ASPHALT.
1 SS		5-6-6-9						1.5-1.9 feet: SAND (SP), light brown, fine to medium sand, trace fines, medium dense, moist.
								1.9-2.1 feet: SILTY SAND (SM), light brown, >66% fine sand, <33% low plastic fines, medium dense, moist.
								2.1-2.4 feet: SAND (SP), as above.
								2.4-2.7 SILTY SAND (SM), as above.
2 SS		2-3-2		5				2.7-3.2 feet: SAND (SP), as above.
								3.2-3.5 feet: NO RECOVERY.
								5.0-5.4 feet: SILTY SAND (SM), as above, loose, moist.
								5.4-6.3 feet: SAND (SP), as above, loose, moist.
								6.3-6.5 feet: NO RECOVERY.
3 SS		2-1-2		10				10.0-11.3 feet: SAND (SP), brown, fine to medium sand, trace fines, up to 10% fine subangular to subrounded gravels, loose, moist.
								11.3-11.5 feet: NO RECOVERY.
4 SS		3-4-4		15				15.0-16.5 feet: SAND (SP), brown, fine to medium sand, trace fines, loose, shoe of split spoon sampler wet at 16.5 feet.
			∇ 17.2' 10-1-93 1255					
				20				

REMARKS

1)SS = Split spoon sample.

EMCON Northwest, Inc.

0235-007.05 (08).23507.elm\2.10-14-93...SEELSW

LOG OF EXPLORATORY BORING

PROJECT NAME CHEMAX
LOCATION Portland, Oregon
DRILLED BY GeoTech Explorations
DRILL METHOD Hollow Stem Auger
LOGGED BY C. Hultgren

BORING NO. MW- 2

REFERENCE ELEV. ±
TOTAL DEPTH 28.00'
DATE COMPLETED 10/1/93

SAMPLE NUMBER SAMPLE TYPE		BLOW COUNTS	GROUND WATER LEVELS	DEPTH IN FEET	SAMPLES	WELL DETAILS	LITHO LOGIC COLUMN	LITHOLOGIC DESCRIPTION
5 SS		1-1-2						20.0-20.8 feet: SAND (SP), gray, fine to medium sand, <10% fines, very loose, wet.
								20.8-21.0 feet: SILTY CLAY (CL), gray, medium plastic, soft, wet.
								21.0-21.1 feet: SAND (SP), as above.
								21.1-21.5 feet: NO RECOVERY.
6 SS		2-3-3-5		25				25.0-26.9 feet: SAND (SP), as above, wet.
								26.9-27.0 feet: NO RECOVERY.
				30				
				35				
				40				

Bottom of boring at 28.0 feet below ground surface.
WELL COMPLETION DETAILS:
0.28 to 17.49 feet: 2-inch-diameter, Schedule 40 PVC riser pipe.
17.49-27.06 feet: Johnson prepacked (20-40 Colorado silica sand) 0.012-inch slotted screen interval.
27.06 to 27.75 feet: 2-inch-diameter Schedule 40 PVC sump.
Sherwood traffic grade flush mount.
0 to 1.5 feet: Concrete.
1.5 to 15.5 feet: Bentonite chips hydrated with potable water.
15.5 to 27.75 feet: 10-20 Colorado silica sand.
27.75 to 28.0 feet: Heave.

REMARKS
1)SS = Split spoon sample.

LOG OF EXPLORATORY BORING

PROJECT NAME CHEMAX
LOCATION Portland, Oregon
DRILLED BY GeoTech Explorations
DRILL METHOD Hollow Stem Auger
LOGGED BY C. Hultgren

BORING NO. MW- 3

REFERENCE ELEV. ±
TOTAL DEPTH 27.52'
DATE COMPLETED 10/4/93

SAMPLE NUMBER SAMPLE TYPE		BLOW COUNTS	GROUND WATER LEVELS	DEPTH IN FEET	SAMPLES	WELL DETAILS	LITHOLOGIC COLUMN	LITHOLOGIC DESCRIPTION
								0-0.5 feet: ASPHALT.
								0.5-1.7 feet: SANDY GRAVEL (GW), dark gray, 70% fine to coarse subangular to angular gravels, <30% fine to coarse sand, dense, damp. (ROAD BASE)
1 SS		6-8-8-8						1.7-3.2 feet: SAND (SP), light brown, fine to medium sand, trace fines, medium dense, damp.
								3.2-3.5 feet: NO RECOVERY.
2 SS		2-2-3		5				5.0-5.7 feet: SAND (SP), brown, fine to medium sand, trace fines, medium dense, damp.
								5.7-6.5 feet: NO RECOVERY.
3 SS		2-2-2		10				10.0-11.2 feet: SAND (SP), brown, fine to medium sand, trace fines, medium dense, damp.
4 SS		2-3-4		15				15.0-16.3 feet: SANDY (SP), brown, fine to medium sand, trace fines, medium dense, moist.
								@ 18.0 feet: drilling change, became softer.
				20				

REMARKS
1)SS = Split Spoon Sample.

EMCON Northwest, Inc.

0235-007.05 (08).23507.slm\2.10-14-93...SEELSW

LOG OF EXPLORATORY BORING

PROJECT NAME	CHEMAX	BORING NO.	MW- 3
LOCATION	Portland, Oregon	PAGE	2 OF 2
DRILLED BY	GeoTech Explorations	REFERENCE ELEV.	±
DRILL METHOD	Hollow Stem Auger	TOTAL DEPTH	27.52'
LOGGED BY	C. Hultgren	DATE COMPLETED	10/4/93

SAMPLE NUMBER SAMPLE TYPE		BLOW COUNTS	GROUND WATER LEVELS	DEPTH IN FEET	SAMPLES	WELL DETAILS	LITHO LOGIC COLUMN	LITHOLOGIC DESCRIPTION
5 SS		3-4-5						20.0-20.9 feet: SAND (SP), gray, fine to medium sand, up to 10% fines, loose, wet.
								20.9-21.0 feet: CLAYEY SILT (ML), gray, medium plastic, soft, wet.
								21.0-21.3 feet: SAND (SP), gray, fine to medium sand, up to 10% fines, loose, wet.
								21.3-21.5 feet: NO RECOVERY.
6 SS		1 for 1.5'		25				25.0-25.9 feet: CLAYEY SILT (ML), gray, medium plastic, soft, wet.
				30				
				35				
				40				

Bottom of boring at 27.5 feet below ground surface.

WELL COMPLETION DETAILS:

0.68-17.26 feet: 2-inch Schedule 40 PVC riser pipe.

17.26-26.82 feet: Johnson prepacked (20-40 Colorado silica sand) 0.012-inch slotted screen interval.

26.82-27.52 feet: 2-inch Schedule 40 PVC sump.

Sherwood traffic grade flush mount.

0-1.5 feet: Concrete.

1.5-15.0 feet: Bentonite chips hydrated with potable water.

15.0-27.5 feet: 10-20 Colorado silica sand.

REMARKS

1)SS = Split Spoon Sample.

EMCON Northwest, Inc.

LOG OF EXPLORATORY BORING

PROJECT NAME	CHEMAX	BORING NO.	MW- 4
LOCATION	Portland, Oregon	PAGE	1 OF 2
DRILLED BY	GeoTech Explorations	REFERENCE ELEV.	±
DRILL METHOD	Hollow Stem Auger	TOTAL DEPTH	28.22'
LOGGED BY	C. Hultgren	DATE COMPLETED	10/1/93

SAMPLE NUMBER SAMPLE TYPE		BLOW COUNTS	GROUND WATER LEVELS	DEPTH IN FEET	SAMPLES	WELL DETAILS	LITHO LOGIC COLUMN	LITHOLOGIC DESCRIPTION
								1.0-2.7 feet: SAND (SP), light brown, fine to medium sand, trace fines, loose, moist.
1 SS		4-5-4-6						
								2.7-3.0 feet: NO RECOVERY.
2 SS		3-2-3		5				5.0-5.8 feet: SAND (SP), light brown, fine to medium sand, trace fines, loose, red staining from 6.35 to 6.80 feet, moist.
								5.8-6.1 feet: SAND (SW), fine to coarse sand, local trace fine subangular gravels, moist.
								6.1-6.5 feet: NO RECOVERY.
3 SS		3-3-4		10				10.0-11.0 feet: SAND (SP), brown, fine to medium sand, trace 20% fines, loose, moist.
								11.0-11.5 feet: NO RECOVERY.
4 SS		3-3-2		15				15.0-15.9 feet: SAND (SP), brown, fine to medium sand, trace 20% fines, loose, wet at approximately 16.5 feet (drive shoe on split spoon sampler wet).
			∇ 17.4' 9-30-93 0935					15.9-16.5 feet: NO RECOVERY.
				20				

REMARKS

1)SS = Split Spoon Sample.

EMCON Northwest, Inc.

0235-007.05 (08).23507.slm\2.10-14-93...SEELSW

LOG OF EXPLORATORY BORING

PROJECT NAME CHEMAX
LOCATION Portland, Oregon
DRILLED BY GeoTech Explorations
DRILL METHOD Hollow Stem Auger
LOGGED BY C. Hultgren

BORING NO. MW- 4
PAGE 2 OF 2
REFERENCE ELEV. ±
TOTAL DEPTH 28.22'
DATE COMPLETED 10/1/93

SAMPLE NUMBER SAMPLE TYPE		BLOW COUNTS	GROUND WATER LEVELS	DEPTH IN FEET	SAMPLES	WELL DETAILS	LITHO LOGIC COLUMN	LITHOLOGIC DESCRIPTION
5 SS		1-1-1-3						20.0-20.9 feet: SAND (SP), gray, 85-90% fine to medium sand, 10-15% fines, very loose, wet.
								20.9-21.25 feet: SANDY SILT (ML), gray, >60% low plastic fines, <40% fine sand, soft, wet.
								21.25-22.0 feet: SILTY SAND (SM), gray, 60-70% fine sand, 30-40% low plastic fines, soft, wet.
6 SS		0-1-1		25				25.0-25.5 feet: SAND (SW), gray, fine to coarse sand, very loose, wet.
								25.5-26.2 feet: CLAYEY SILT (ML), gray, medium plastic, soft, wet.
								26.2-26.5 feet: NO RECOVERY.
				30				
				35				
				40				

Bottom of boring at 28.22 feet below ground surface.

WELL COMPLETION DETAILS:

0.50-17.96 feet: 2-inch Schedule 40 PVC riser.
17.96-27.53 feet: Johnson prepacked (20-40 Colorado silica sand) 0.012-inch slotted screen interval.
27.53-28.22 feet: 2-inch Schedule 40 PVC sump.
Sherwood traffic grade flush mount.
0-1.5 feet: Concrete.
1.5-16.0 feet: Bentonite chips hydrated with potable water.
16.0-28.22 feet: 10-20 Colorado silica sand.

REMARKS
1)SS = Split Spoon Sample.

LOG OF EXPLORATORY BORING

PROJECT NAME CHEMAX
LOCATION Portland, Oregon
DRILLED BY GeoTech Explorations
DRILL METHOD Hollow Stem Auger
LOGGED BY C. Hultgren

BORING NO. MW- 5
PAGE 1 OF 3
REFERENCE ELEV. ±
TOTAL DEPTH 35.50'
DATE COMPLETED 9/30/93

SAMPLE NUMBER SAMPLE TYPE		BLOW COUNTS	GROUND WATER LEVELS	DEPTH IN FEET	SAMPLES	WELL DETAILS	LITHO LOGIC COLUMN	LITHOLOGIC DESCRIPTION
1 SS		8-9-12						1.0-1.2 feet: SILTY SAND (SM), brown, 70% fine sand, 30% fines, medium dense, trace fine angular gravels, moist.
								1.2-2.2 feet: SAND (SW), brown, >90% fine to coarse sand, <10% fines, medium dense, moist, some green and red colored grains and local red and white staining. (paint or product?)
								2.2-2.5 feet: NO RECOVERY.
2 SS		2-1-1		5				5.0-5.4 feet: SAND (SW), light brown, 80% fine to coarse sand, 20% low plastic fines, local red staining (paint or product?), very loose, moist.
								5.4-6.0 feet: SAND (SP), light brown, fine to medium sand, trace fines, very loose, moist.
								6.0-7.5 feet: NO RECOVERY.
3 SS		3-2-3		10				10.0-11.5 feet: SAND (SP), light brown, fine to medium sand, trace fines, very loose, moist.
4 SS		2-3-4		15				15.0-16.5 feet: SAND (SP), light brown, fine to medium sand, trace fines, very loose, moist.
								Note: drilling change at 18.0 feet, became softer.
				20				

REMARKS
1) SS = Split Spoon Sample.

EMCON Northwest, Inc.

0235-007.05 (08).23507.sim\2.10-14-93...SEELSW

LOG OF EXPLORATORY BORING

PROJECT NAME	CHEMAX	BORING NO.	MW- 5
LOCATION	Portland, Oregon	PAGE	2 OF 3
DRILLED BY	GeoTech Explorations	REFERENCE ELEV.	±
DRILL METHOD	Hollow Stem Auger	TOTAL DEPTH	35.50'
LOGGED BY	C. Hultgren	DATE COMPLETED	9/30/93

SAMPLE NUMBER SAMPLE TYPE		BLOW COUNTS	GROUND WATER LEVELS	DEPTH IN FEET	SAMPLES	WELL DETAILS	LITHO LOGIC COLUMN	LITHOLOGIC DESCRIPTION
5 SS		1 for 1.5'						20.0-20.05 feet: SAND (SW), gray, fine to coarse, very loose, very moist.
								20.05-21.5 feet: CLAYEY SILT (ML), gray, medium plastic fines, very soft, moist to wet.
6 SS		1 for 1.5'		25				25.0-26.5 feet: CLAYEY SILT (ML), gray, medium plastic fines, very soft, moist to wet.
			∇ 26.4' 9-30-93 1500					
7 SS		1-1-1		30				30.0-30.4 feet: CLAYEY SILT (ML), gray, medium plastic fines, very soft, moist to wet.
								30.4-31.5 feet: SANDY SILT (ML), gray, 80% low plastic fines, 20% fine sand, soft, wet.
				35				Bottom of boring at 35.5 feet below ground surface.
				40				

Bottom of boring at 35.5 feet below ground surface.

WELL COMPLETION DETAILS

0.36-25.24 feet: 2-inch Schedule 40 PVC riser.

25.24-34.81 feet: Johnson prepacked (20-40 Colorado silica sand) 0.012-inch slotted screen interval.

34.81-35.50 feet: 2-inch Schedule 40 PVC sump.

Sherwood traffic grade flush mount.

0-1.5 feet: Concrete.

REMARKS

1)SS=Split Spoon Sample.

EMCON Northwest, Inc.

0235-007.05 (08).23507.alm\2.10-14-93...SEELSW

LOG OF EXPLORATORY BORING

PROJECT NAME McCALL OIL/GREAT WESTERN CHEMICAL CO.
LOCATION Portland, Oregon
DRILLED BY GeoTech Explorations
DRILL METHOD Hollow Stem Auger
LOGGED BY Bill Ehorn

BORING NO. EX- 1
PAGE 2 OF 2
REFERENCE ELEV. ±
TOTAL DEPTH 25.00'
DATE COMPLETED 9/6/94

SAMPLE NUMBER (METHOD)	FID (ppm) RECOVERY PERCENT	BLOW COUNTS	GROUND WATER LEVELS	DEPTH IN FEET	SAMPLES	WELL DETAILS	LITHO LOGIC COLUMN	LITHOLOGIC DESCRIPTION
13 (SS)	— 100%	2-2-3						
14 (SS)	3 100%	4-5-11						@ 22.5-23.0 feet: color changed to gray.
15 (SS)	— 100%	2-3-4						23.7-25.0 feet: ELASTIC SILT (MH), medium gray, medium plasticity, moist, firm, trace organic matter. (ALLUVIUM)
				25				Bottom of boring at 25.0 feet below ground surface.
				30				
				35				
				40				

WELL CONSTRUCTION DETAILS:
Well was constructed of 2-inch flush threaded schedule 40 PVC with a 0.010-inch machine slotted screen. The filter pack consists of washed 20x40 Colorado silica sand. The surface seal consists of Volclay bentonite chips hydrated with potable water. The well was completed with a heavy duty flush mount security casing cemented into place.

REMARKS
1)SS = 2-inch split spoon sampler. 2)G = Grab sample. 3)FID = Flame ionzation detector.

EMCON Northwest, Inc.

0235-007.05.23506.mmm\0.9-21-94...SEELSW

LOG OF EXPLORATORY BORING

PROJECT NAME	McCALL OIL/GREAT WESTERN CHEMICAL CO.	BORING NO.	EX- 2
LOCATION	Portland, Oregon	PAGE	1 OF 2
DRILLED BY	GeoTech Explorations	REFERENCE ELEV.	±
DRILL METHOD	Hollow Stem Auger	TOTAL DEPTH	25.50'
LOGGED BY	Bill Ehorn	DATE COMPLETED	9/6/94

SAMPLE NUMBER (METHOD)	FID (ppm) RECOVERY PERCENT	BLOW COUNTS	GROUND WATER LEVELS	DEPTH IN FEET	LITHOLOGIC DESCRIPTION
					0-0.2 feet: ASPHALT.
1 (G)	0 100%	—			0.2-1.5 feet: SILTY GRAVEL WITH SAND (GM), medium brown, 40-50% subangular to angular fine gravel, 30-40% subrounded to subangular fine to coarse sand, 10-20% non-plastic fines, damp. (FILL)
2 (G)	0 100%	—			
3 (G)	0 100%	—			1.5-25.5 feet: POORLY GRADED SAND WITH SILT (SP-SM), medium gray, 85-90% subrounded to subangular fine sand, 10-15% non-plastic fines, medium dense, damp. (DREDGE SPOILS)
				5	
4 (G)	0 100%	—			
5 (SS)	0 100%	6-9-9			
6 (SS)	60 100%	4-5-6			
7 (SS)	5 100%	10-8-10		10	@ 10.0 feet: noticeable white quartz sand grains.
8 (SS)	10 100	6-7-7			@ 11.5 feet: iron oxide staining evident.
9 (SS)	110 100%	4-4-4			
10 (SS)	70 100%	4-5-7		15	
11 (SS)	105 100%	3-4-8			
12 (SS)	2 100%	4-10-11	18.5'		@ 18.5 feet: first water, cuttings are wet.
13 (SS)	2600 100%	12-10-14	18.56'		
				20	

REMARKS

1)SS = 2-inch split spoon sampler. 2)G = Grab sample. 3)FID = Flame Ionzation detector.

EMCON Northwest, Inc.

0235-007.05.23505.mmm\0.9-21-94...SEELSW

LOG OF EXPLORATORY BORING

PROJECT NAME McCALL OIL/GREAT WESTERN CHEMICAL CO.
LOCATION Portland, Oregon
DRILLED BY GeoTech Explorations
DRILL METHOD Hollow Stem Auger
LOGGED BY Bill Ehorn

BORING NO. EX- 2
PAGE 2 OF 2
REFERENCE ELEV. ±
TOTAL DEPTH 25.50'
DATE COMPLETED 9/6/94

SAMPLE NUMBER (METHOD)	FID (ppm) RECOVERY PERCENT	BLOW COUNTS	GROUND WATER LEVELS	DEPTH IN FEET	SAMPLES	WELL DETAILS	LITHO LOGIC COLUMN	LITHOLOGIC DESCRIPTION
14 (SS)	3000 100%	4-4-5						
15 (SS)	3050 100%	3-1-2						@ 22.7-25.5 feet: interbedded elastic silt lenses with traces of organic matter.
16 (SS)	4100 100%	2-6-7						
				25				Bottom of boring at 25.5 feet below ground surface.
				30				**WELL CONSTRUCTION DETAILS:** Well was constructed of 2-inch flush threaded schedule 40 PVC with a 0.010-inch machine slotted screen. The filter pack consists of washed 20x40 Colorado silica sand. The surface seal consists of Volclaybentonite chips hydrated with potable water. The well was completed with a heavy duty flush mount security casing cemented into place.
				35				
				40				

REMARKS

1)SS = 2-inch split spoon sampler. 2)G = Grab sample. 3)FID = Flame ionzation detector.

LOG OF EXPLORATORY BORING

PROJECT NAME McCALL OIL/GREAT WESTERN CHEMICAL CO.
LOCATION Portland, Oregon
DRILLED BY GeoTech Explorations
DRILL METHOD Hollow Stem Auger
LOGGED BY Bill Ehorn

BORING NO. EX- 3

REFERENCE ELEV. ±
TOTAL DEPTH 26.00'
DATE COMPLETED 9/6/94

SAMPLE NUMBER (METHOD)	FID (ppm) RECOVERY PERCENT	BLOW COUNTS
1 (G)	0 100%	---
2 (G)	0 100%	---
3 (G)	0 100%	---
4 (SS)	650 100%	8-7-5
5 (SS)	400 100%	3-4-3
6 (SS)	1100 100%	4-5-6
7 (SS)	750 100%	4-4-6
8 (SS)	1050 100%	4-3-3
9 (SS)	700 100%	4-5-7
10 (SS)	750 100%	4-8-8
11 (SS)	3000 100%	4-5-7
12 (SS)	1040 100%	7-4-5

GROUND WATER LEVELS: 17.0' ; 17.96'

DEPTH IN FEET: 5, 10, 15, 20

SAMPLES | WELL DETAILS | LITHO LOGIC COLUMN

LITHOLOGIC DESCRIPTION

0-3.0 feet: SILTY SAND-SANDY SILT (SM/ML), orange brown, 40-60% subrounded to subangular fine sand, 40-60% non-plastic fines, dry, loose.

3.0-6.5 feet: SILTY SAND (SM), medium gray, 75-85% subrounded to subangular fine sand, 15-25% non-plastic fines, dry, soft. (DREDGE SPOILS)

6.5-25.5 feet: POORLY GRADED SAND WITH SILT (SP-SM), dark gray, 90-95% subrounded to subangular fine sand, 5-10% non-plastic fines, dry, loose. (DREDGE SPOILS)

@ 17.0 feet: first water, wet cuttings.

@ 19.0 feet: iron oxide staining evident.

REMARKS

1)SS = 2-inch split spoon sampler. 2)G = Grab sample. 3)FID = Flame Ionzation detector.

EMCON Northwest, Inc.

0235-007.05.23505.mmm\0.9-21-94...SEELSW

LOG OF EXPLORATORY BORING

PROJECT NAME	McCALL OIL/GREAT WESTERN CHEMICAL CO.	BORING NO.	EX- 3
LOCATION	Portland, Oregon	PAGE	2 OF 2
DRILLED BY	GeoTech Explorations	REFERENCE ELEV.	±
DRILL METHOD	Hollow Stem Auger	TOTAL DEPTH	26.00'
LOGGED BY	Bill Ehorn	DATE COMPLETED	9/6/94

SAMPLE NUMBER (METHOD)	FID (ppm) RECOVERY PERCENT	BLOW COUNTS	GROUND WATER LEVELS	DEPTH IN FEET	SAMPLES	WELL DETAILS	LITHO LOGIC COLUMN	LITHOLOGIC DESCRIPTION
13 (SS)	3100 100%	1-2-2						
14 (SS)	5500 100%	1-2-3						
15 (SS)	4500 100%	2-3-3		25				
								25.5-26.0 feet: ELASTIC SILT (MH), medium gray, medium plasticity, firm, trace organic matter, moist. (ALLUVIUM)
								Bottom of boring at 26.0 feet below ground surface.
				30				
				35				
				40				

WELL CONSTRUCTION DETAILS:

Well was constructed of 2-inch flush threaded schedule 40 PVC with a 0.010-inch machine slotted screen. The filter pack consists of washed 20x40 Colorado silica sand. The surface seal consists of Volclay bentonite chips hydrated with potable water. The well was completed with a heavy duty flush mount security casing cemented into place.

REMARKS

1)SS = 2-inch split spoon sampler. 2)G = Grab sample. 3)FID = Flame lonzation detector.

LOG OF EXPLORATORY BORING

EX-41

PROJECT NAME	CHEMAX	BORING NO.	MW- 2
LOCATION	Portland, Oregon	PAGE	1 OF 2
DRILLED BY	GeoTech Explorations	REFERENCE ELEV.	±
DRILL METHOD	Hollow Stem Auger	TOTAL DEPTH	28.00'
LOGGED BY	C. Hultgren	DATE COMPLETED	10/1/93

SAMPLE NUMBER SAMPLE TYPE		BLOW COUNTS	GROUND WATER LEVELS	DEPTH IN FEET	SAMPLES	WELL DETAILS	LITHO LOGIC COLUMN	LITHOLOGIC DESCRIPTION
								0-1.5 feet: ASPHALT.
1 SS		5-6-6-9						1.5-1.9 feet: SAND (SP), light brown, fine to medium sand, trace fines, medium dense, moist.
								1.9-2.1 feet: SILTY SAND (SM), light brown, >66% fine sand, <33% low plastic fines, medium dense, moist.
								2.1-2.4 feet: SAND (SP), as above.
								2.4-2.7 SILTY SAND (SM), as above.
2 SS		2-3-2		5				2.7-3.2 feet: SAND (SP), as above.
								3.2-3.5 feet: NO RECOVERY.
								5.0-5.4 feet: SILTY SAND (SM), as above, loose, moist.
								5.4-6.3 feet: SAND (SP), as above, loose, moist.
								6.3-6.5 feet: NO RECOVERY.
3 SS		2-1-2		10				10.0-11.3 feet: SAND (SP), brown, fine to medium sand, trace fines, up to 10% fine subangular to subrounded gravels, loose, moist.
								11.3-11.5 feet: NO RECOVERY.
4 SS		3-4-4		15				15.0-16.5 feet: SAND (SP), brown, fine to medium sand, trace fines, loose, shoe of split spoon sampler wet at 16.5 feet.
			∇ 17.2' 10-1-93 1255					
				20				

REMARKS

1)SS = Split spoon sample.

EMCON Northwest, Inc.

0235-007.05 (08).23507.elm\2.10-14-93...SEELSW

LOG OF EXPLORATORY BORING

EX-4/

PROJECT NAME	CHEMAX	BORING NO.	MW-2
LOCATION	Portland, Oregon	PAGE	2 OF 2
DRILLED BY	GeoTech Explorations	REFERENCE ELEV.	±
DRILL METHOD	Hollow Stem Auger	TOTAL DEPTH	28.00'
LOGGED BY	C. Hultgren	DATE COMPLETED	10/1/93

SAMPLE NUMBER SAMPLE TYPE		BLOW COUNTS	GROUND WATER LEVELS	DEPTH IN FEET	SAMPLES	WELL DETAILS	LITHO LOGIC COLUMN	LITHOLOGIC DESCRIPTION
5 SS		1-1-2						20.0-20.8 feet: SAND (SP), gray, fine to medium sand, <10% fines, very loose, wet.
								20.8-21.0 feet: SILTY CLAY (CL), gray, medium plastic, soft, wet.
								21.0-21.1 feet: SAND (SP), as above.
								21.1-21.5 feet: NO RECOVERY.
6 SS		2-3-3-5		25				25.0-26.9 feet: SAND (SP), as above, wet.
								26.9-27.0 feet: NO RECOVERY.
								Bottom of boring at 28.0 feet below ground surface. WELL COMPLETION DETAILS: 0.28 to 17.49 feet: 2-inch-diameter, Schedule 40 PVC riser pipe. 17.49-27.06 feet: Johnson prepacked (20-40 Colorado silica sand) 0.012-inch slotted screen interval. 27.06 to 27.75 feet: 2-inch-diameter Schedule 40 PVC sump. Sherwood traffic grade flush mount. 0 to 1.5 feet: Concrete. 1.5 to 15.5 feet: Bentonite chips hydrated with potable water. 15.5 to 27.75 feet: 10-20 Colorado silica sand. 27.75 to 28.0 feet: Heave.
				30				
				35				
				40				

REMARKS

1)SS = Split spoon sample.

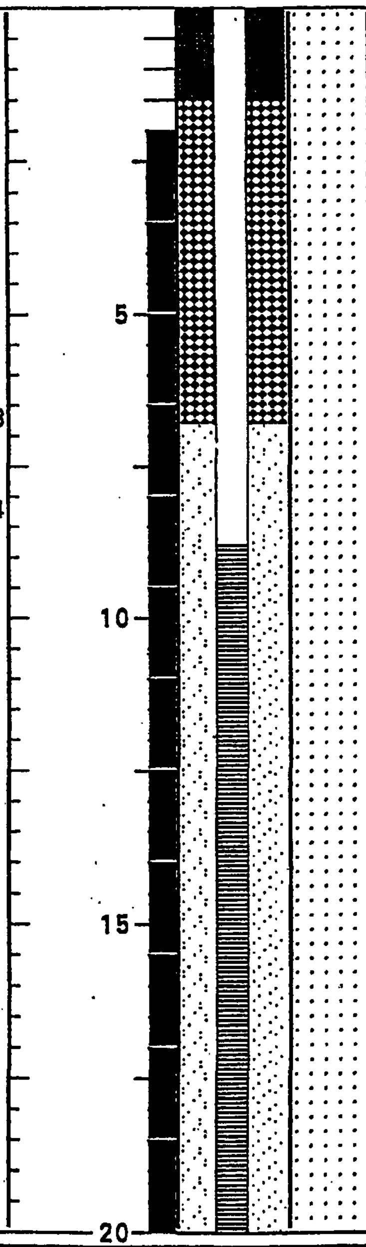
EMCON Northwest, Inc.

LOG OF EXPLORATORY BORING

PROJECT NAME	McCall Oil and Chemical Corporation	BORING NO.	EX- 5
LOCATION	Portland, Oregon	PAGE	1 OF 2
DRILLED BY	GeoTech Explorations, Inc.	GROUND ELEV.	32.33'
DRILL METHOD	Hollow Stem Auger	TOTAL DEPTH	24.00'
LOGGED BY	Mike Free	DATE COMPLETED	12/19/94

SAMPLE NUMBER SAMPLE TYPE	RECOVERY PERCENT (FID, ppm)	BLOW COUNTS (N COMP)
2" SS	87 (0)	5-8-11 (19)
2" SS	73 (6)	7-11-14 (25)
EX-5-5' 2" SS	67 (60)	6-10-19 (29)
3" SS	73 (15)	11-24-33 (57)
3" SS	100 (700)	14-26-34 (60)
3" SS	60 (15)	5-6-11 (17)
2" SS	67 (27)	4-3-4 (7)
2" SS	67 (10)	3-5-8 (13)
2" SS	87 (270)	9-16-18 (34)
2" SS	87 (500)	8-14-20 (34)
EX-5-17 2" SS	80 (400)	7-16-19 (35)
3" SS	73 (800)	5-12-13 (25)

GROUND WATER LEVELS | DEPTH IN FEET | SAMPLES | WELL DETAILS | LITHOLOGIC COLUMN



LITHOLOGIC DESCRIPTION

0 to 24.0 feet: SAND (SP), dark orangish brown to dark grayish brown, 50 to 60 percent medium sand, 40 to 50 percent fine sand, loose, moist, gravel (crushed basalt) at surface. (FILL)

@ 3.5 feet: dark grayish brown.

@ 4.9 feet: 0.1-foot layer of silty fine sand.

@ 6.2 feet: 1 cm layer of light gray ash (?).

@ 6.5 feet: dark gray.

@ 7.2 feet: 1.6 foot of mixed light gray fine sand and silt with medium to coarse sand, trace fine gravel, one piece of soft brittle tar (?), 7 mm across.

@ 17.0 feet: wet.

@ 19.5 feet: silty fine sand and fine sand 80 to 90 percent fine sand, 10 to 20 percent fines, a few layers of sand (as above), wet, organics common.

REMARKS

FID = Flame ionization detector, measurements in parts per million (ppm). SS = split spoon.

EMCON

LOG OF EXPLORATORY BORING

PROJECT NAME	McCall Oil and Chemical Corporation	BORING NO.	EX- 5
LOCATION	Portland, Oregon	PAGE	2 OF 2
DRILLED BY	GeoTech Explorations, Inc.	GROUND ELEV.	32.33'
DRILL METHOD	Hollow Stem Auger	TOTAL DEPTH	24.00'
LOGGED BY	Mike Free	DATE COMPLETED	12/19/94

SAMPLE NUMBER SAMPLE TYPE	RECOVERY PERCENT (FID, ppm)	BLOW COUNTS (N COMP)	GROUND WATER LEVELS	DEPTH IN FEET	SAMPLES	WELL DETAILS	LITHOLOGIC COLUMN	LITHOLOGIC DESCRIPTION
3" SS	80 (1050)	5-6-12 (18)						0 to 24.0 feet: SAND (SP), continued.
								@ 20.3 feet: 0.04-foot layer of organics.
3" SS	87 (2000)	7-10-9 (19)						@ 21.5 feet: 60 percent fine sand, 40 percent medium sand.
								Total depth drilled = 24.0 feet. Total depth sampled = 23.0 feet.
				25				
								WELL COMPLETION DETAILS: 0 to 8.8 foot: 2-inch-diameter, flush-threaded, Schedule 40 PVC blank riser pipe. 8.8 to 23.3 feet: 2-inch-diameter, flush-threaded, Schedule 40 PVC well screen with 0.010-inch machine-cut slots. 23.3 to 24.0 feet: 2-inch-diameter, flush-threaded, Schedule 40 PVC end cap.
				30				
								0 to 1.5 feet: Concrete. 1.5 to 6.8 feet: Bentonite chips hydrated with potable water. 6.8 to 24.0 feet: 20 x 40 Colorado silica sand.
				35				
				40				

REMARKS

FID = Flame ionization detector, measurements in parts per million (ppm). SS = split spoon.

EMCON

LOG OF EXPLORATORY BORING

PROJECT NAME	McCall Oil and Chemical Corporation	BORING NO.	EX- 6
LOCATION	Portland, Oregon	PAGE	1 OF 2
DRILLED BY	GeoTech Explorations, Inc.	GROUND ELEV.	35.01'
DRILL METHOD	Hollow Stem Auger	TOTAL DEPTH	25.00'
LOGGED BY	Mike Free	DATE COMPLETED	12/19/94

SAMPLE NUMBER SAMPLE TYPE	RECOVERY PERCENT (FID, ppm)	BLOW COUNTS (N COMP)	GROUND WATER LEVELS	DEPTH IN FEET	SAMPLES	WELL DETAILS	LITHOLOGIC COLUMN	LITHOLOGIC DESCRIPTION
3" SS	100 (0)	29-28-31 (59)						0 to 14.3 feet: SAND (SP), dark grayish brown, 50 percent medium sand, 45 percent fine sand, 5 percent fines, occasional gravel (crushed rock) to 1.5 feet, loose, damp, trace wood bark, to 1-inch-long, crushed gravel at surface. (FILL)
2" SS	100 (6)	9-20-22 (42)						
3" SS	113 (5)	12-16-22 (38)						@ 4.0 feet: dark orangish brown, 60 percent fine sand, 40 percent medium sand, trace fines.
EX-6-4.5' 2" SS	93 (50)	10-17-21 (38)		5				
3" SS	67 (300)	12-17-19 (36)						@ 7.0 feet: dark gray, 55 to 65 percent medium sand, 25 to 35 percent fine sand, 5 percent white medium sand, trace fines, trace wood, trace silt lenses.
2" SS	67 (630)	3-7-16 (23)						
3" SS	80 (40)	10-20-19 (39)		10				
2" SS	80 (5)	8-8-9 (17)						
3" SS	73 (70)	7-8-10 (18)						@ 13.0 feet: trace petroleum-like odor.
EX-6-13.5' 2" SS	87 (1500)	2-2-2 (4)						14.3 to 14.8 feet: CLAYEY SILT (ML), very dark grayish to olive brown, some organic debris, soft, wet, petroleum odor. (ALLUVIUM)
EX-6-15 3" SS	87 (1700)	9-10-11 (21)		15				14.8 to 15.0 feet: WOODY AND ORGANIC DEBRIS, black, loose, wet, sheen, petroleum odor. (ALLUVIUM)
2" SS	100 (530)	2-2-2 (4)						15.0 to 23.0 feet: SAND (SP), grayish brown, 60 percent medium sand, 40 percent fine sand, soft, wet, fine roots common. (ALLUVIUM)
2" SS	7 (NR)	1/18" (1)		20				

REMARKS

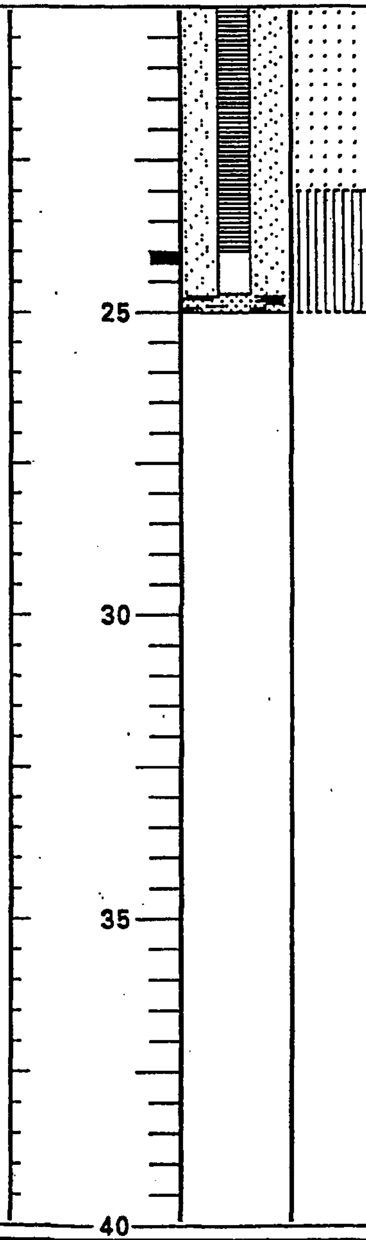
FID = Flame ionization detector, measurements in parts per million (ppm). Heave encountered at approximately 18.0 feet, approximately 10 gallons of potable water added. SS = Split spoon. NR = No reading.

EMCON

LOG OF EXPLORATORY BORING

PROJECT NAME	McCall Oil and Chemical Corporation	BORING NO.	EX- 6
LOCATION	Portland, Oregon	PAGE	2 OF 2
DRILLED BY	GeoTech Explorations, Inc.	GROUND ELEV.	35.01'
DRILL METHOD	Hollow Stem Auger	TOTAL DEPTH	25.00'
LOGGED BY	Mike Free	DATE COMPLETED	12/19/94

SAMPLE NUMBER SAMPLE TYPE	RECOVERY PERCENT (FID, ppm)	BLOW COUNTS (N COMP)	GROUND WATER LEVELS	DEPTH IN FEET	SAMPLES	WELL DETAILS	LITHOLOGIC COLUMN	LITHOLOGIC DESCRIPTION
								15.0 to 23.0 feet: SAND (SP), continued.
GRAB	(600)							23.0 to 25.0 feet: SILT WITH FINE SAND (ML), very dark gray, 90 percent fines, 10 percent fine sand, soft, wet. (ALLUVIUM)



Total depth drilled = 25.0 feet.
Total depth sampled = 24.0 feet.

WELL COMPLETION DETAILS:
0 to 9.6 feet: 2-inch-diameter, flush-threaded, Schedule 40 PVC blank riser pipe.
9.6 to 24.0 feet: 2-inch-diameter, flush-threaded, Schedule 40 PVC well screen with 0.010-inch machine-cut slots.
24.0 to 24.7 feet: 2-inch-diameter, flush-threaded, Schedule 40 PVC end cap.

0 to 1.5 feet: Concrete.
1.5 to 7.6 feet: Bentonite chips hydrated with potable water.
9.6 to 24.7 feet: 20 x 40 Colorado silica sand.
24.7 to 25.0 feet: Heave.

REMARKS
FID = Flame ionization detector, measurements in parts per million (ppm). Heave encountered at approximately 18.0 feet, approximately 10 gallons of potable water added. SS = Split spoon. NR = No reading.

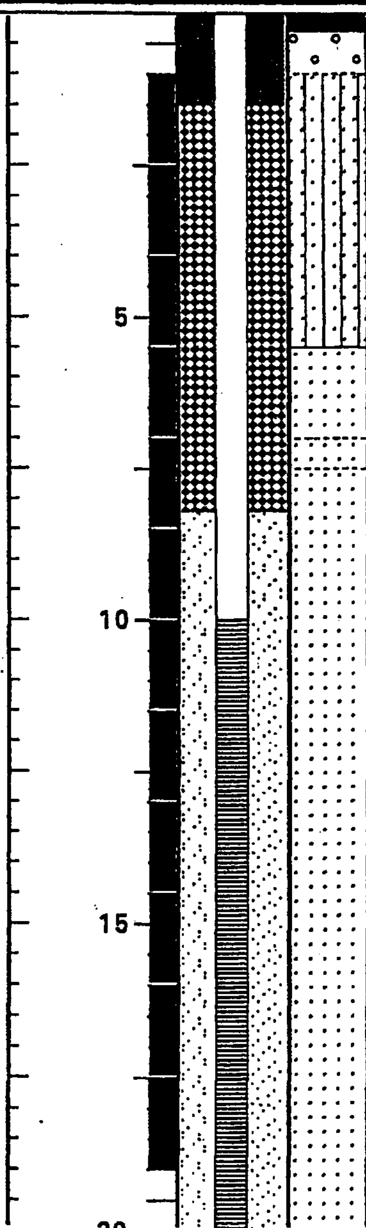
EMCON

LOG OF EXPLORATORY BORING

PROJECT NAME	McCall Oil and Chemical Corporation	BORING NO.	EX- 7
LOCATION	Portland, Oregon	PAGE	1 OF 2
DRILLED BY	GeoTech Explorations, Inc.	GROUND ELEV.	36.04'
DRILL METHOD	Hollow Stem Auger	TOTAL DEPTH	25.30'
LOGGED BY	Mike Free	DATE COMPLETED	12/19/94

SAMPLE NUMBER SAMPLE TYPE	RECOVERY PERCENT (FID, ppm)	BLOW COUNTS (N COMP)
2" SS	87 (0)	5-8-9 (17)
2" SS	87 (0)	4-7-10 (17)
EX-7-4' 2" SS	80 (15)	4-5-5 (10)
2" SS	67 (5)	3-4-4 (8)
2" SS	73 (4)	1-3-7 (10)
3" SS	80 (0)	6-10-15 (25)
2" SS	73 (2)	5-8-10 (18)
2" SS	80 (0)	6-11-15 (26)
2" SS	80 (4)	6-7-14 (21)
EX-7-14.5' 2" SS	87 (2)	4-8-11 (19)
2" SS	87 (0)	4-6-11 (17)
3" SS	33 (4)	2-5-10 (15)

GROUND WATER LEVELS | DEPTH IN FEET | SAMPLES | WELL DETAILS | LITHOLOGIC COLUMN



LITHOLOGIC DESCRIPTION

0 to 0.3 foot: ASPHALT

0.3 to 1.0 feet: GRAVEL (GP), crushed base rock.

1.0 to 5.5 feet: FINE SAND (SP-SM), brown, 90 percent fine sand, 10 percent fines, trace medium sand, loose, moist with occasional silt layer to 1-inch. (FILL)

5.5 to 7.0 feet: FINE SAND (SP), grayish brown, 70 percent fine sand, 30 percent medium sand interlayered with fine sand to 3/4-inch-thick, loose, moist, micaceous. (ALLUVIUM)

7.0 to 7.5 feet: SILTY FINE SAND (SP), grayish brown, 70 percent fine sand, 30 percent silt, loose, wet (perched water), micaceous. (ALLUVIUM)

7.5 to 25.3 feet: MEDIUM SAND (SP), brown, 60 percent medium sand, 40 percent fine sand, subangular to rounded, loose, moist. (ALLUVIUM)

@ 14.5 feet: wet.

REMARKS

FID = Flame ionization detector, measurements in parts per million (ppm). Heave encountered at approximately 17.0 feet, approximately 40 gallons of potable water added. SS = Split spoon.

EMCON

LOG OF EXPLORATORY BORING

PROJECT NAME	McCall Oil and Chemical Corporation	BORING NO.	EX- 7
LOCATION	Portland, Oregon	PAGE	2 OF 2
DRILLED BY	GeoTech Explorations, Inc.	GROUND ELEV.	36.04'
DRILL METHOD	Hollow Stem Auger	TOTAL DEPTH	25.30'
LOGGED BY	Mike Free	DATE COMPLETED	12/19/94

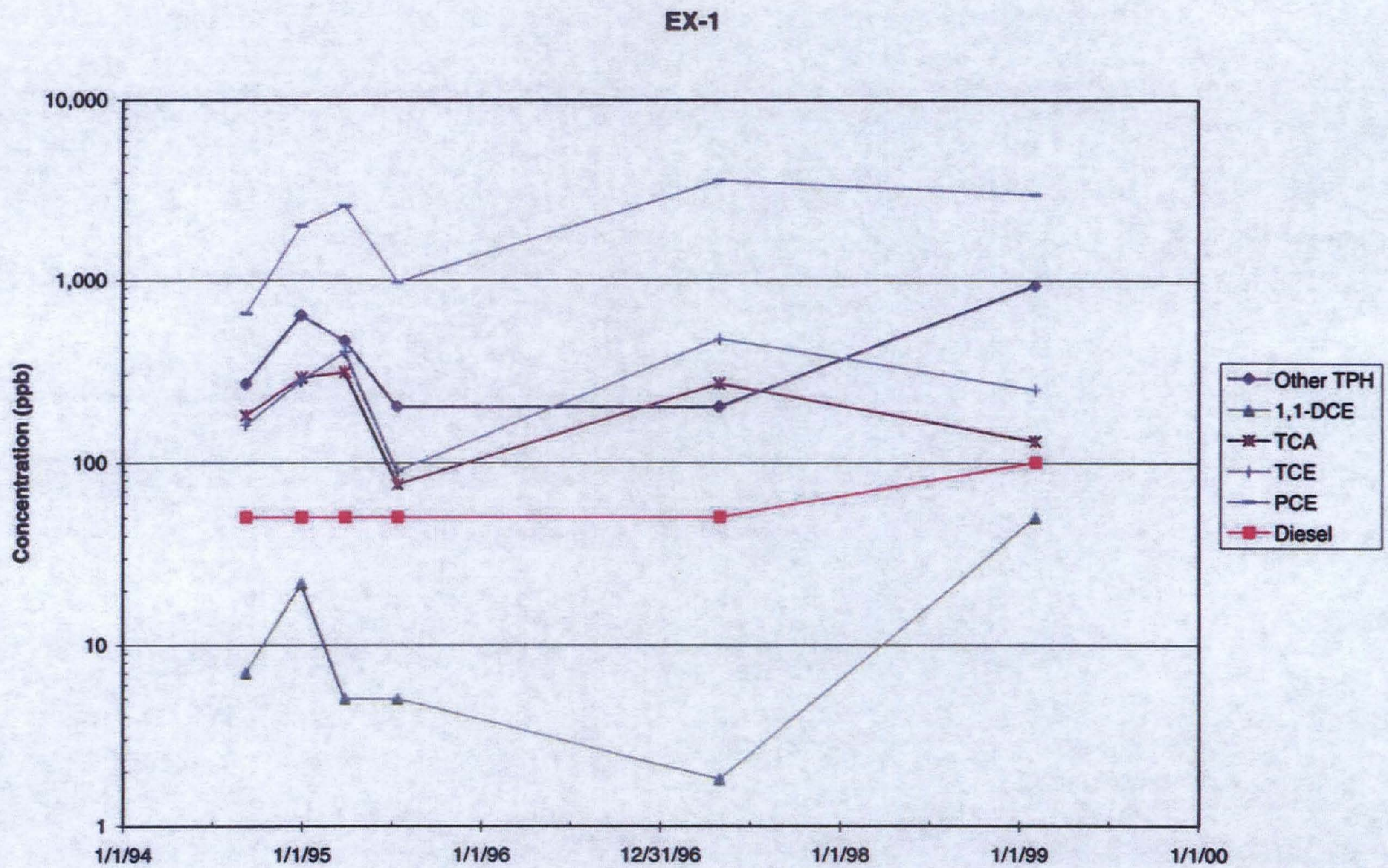
SAMPLE NUMBER SAMPLE TYPE	RECOVERY PERCENT (FID, ppm)	BLOW COUNTS (N COMP)	GROUND WATER LEVELS	DEPTH IN FEET	SAMPLES	WELL DETAILS	LITHOLOGIC COLUMN	LITHOLOGIC DESCRIPTION
								7.5 to 25.3 feet: MEDIUM SAND (SP), continued.
								@ 20.0 feet: dark gray.
				25				Total depth drilled = 25.3 feet. Total depth sampled = 19.0 feet.
				30				WELL COMPLETION DETAILS: 0 to 10.0 feet: 2-inch-diameter, flush-threaded, Schedule 40 PVC blank riser pipe. 10.0 to 24.6 feet: 2-inch-diameter, flush-threaded, Schedule 40 PVC well screen with 0.010-inch machine-cut slots. 24.6 to 25.3 feet: 2-inch-diameter, flush-threaded, Schedule 40 PVC end cap. 0 to 1.5 feet: Concrete. 1.5 to 8.2 feet: Bentonite chips hydrated with potable water. 8.2 to 25.3 feet: 20 x 40 Colorado silica sand.
				35				
				40				

REMARKS

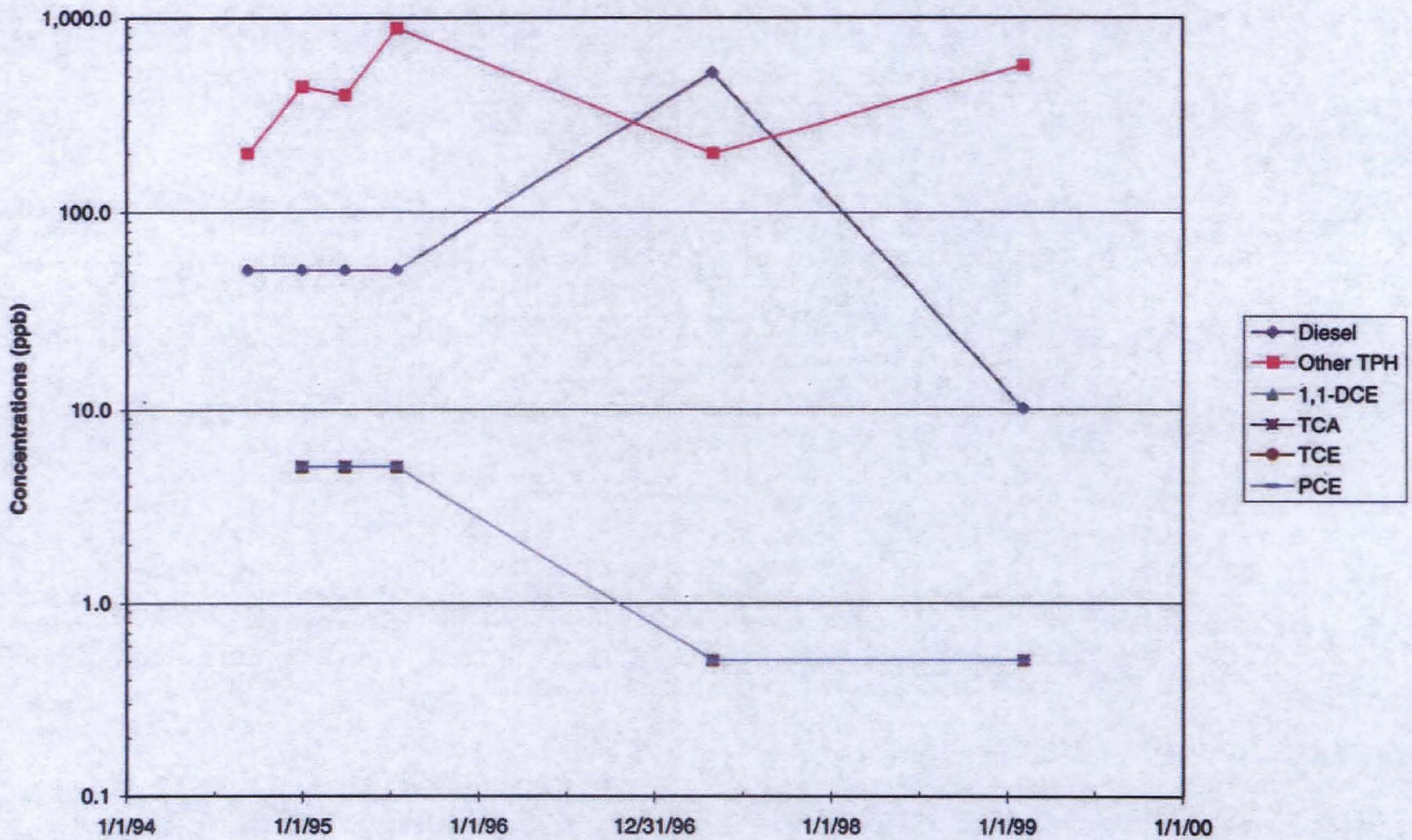
FID = Flame ionization detector, measurements in parts per million (ppm). Heave encountered at approximately 17.0 feet, approximately 40 gallons of potable water added. SS = Split spoon.

EMCON

APPENDIX F
WATER QUALITY – TIME SERIES CONCENTRATION PLOTS

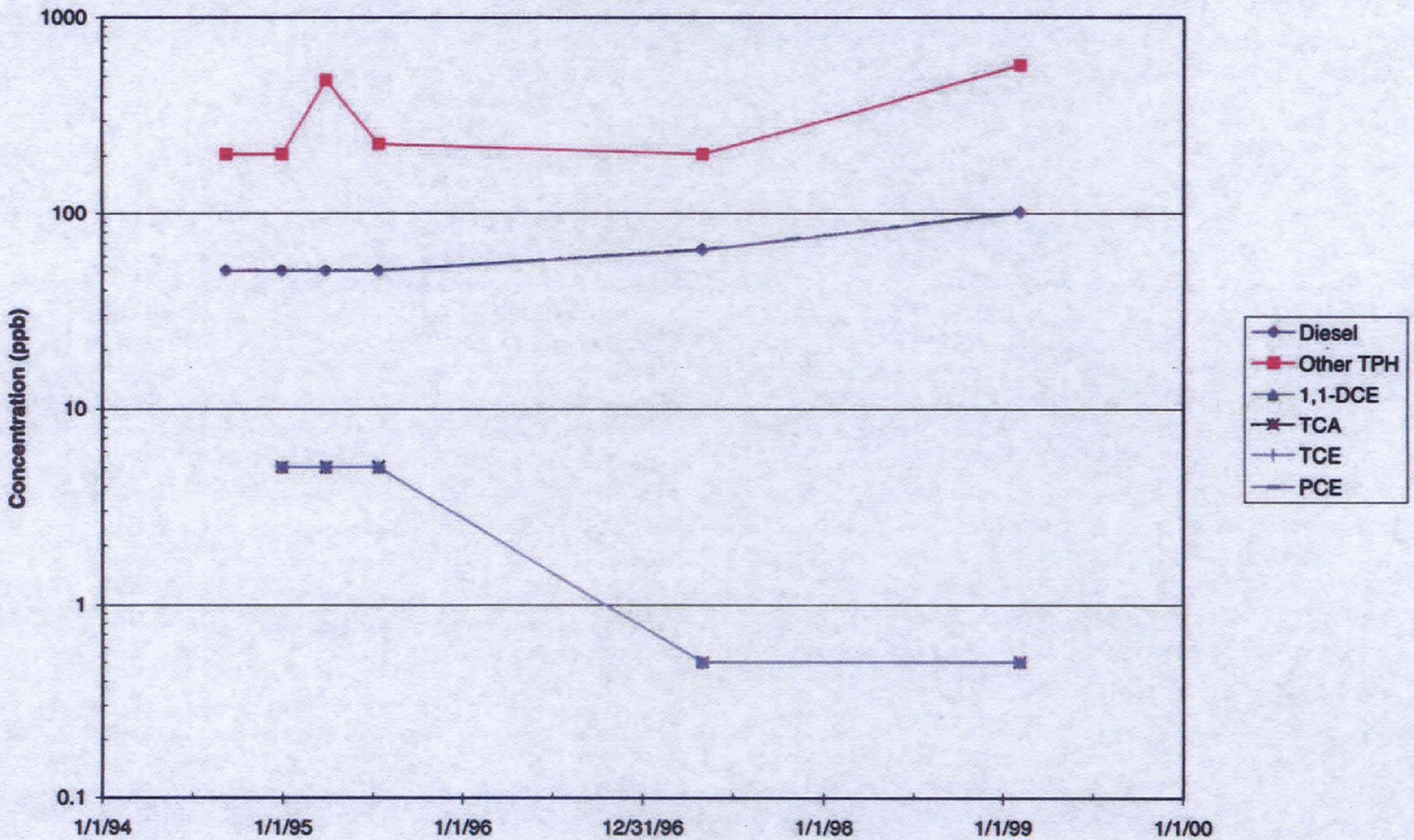

EX-1
10,000
1,000
100
10
1
Concentration (ppb)
1/1/94
1/1/95
1/1/96
12/31/96
1/1/98
1/1/99
1/1/00
Other TPH
1,1-DCE
TCA
TCE
PCE
Diesel

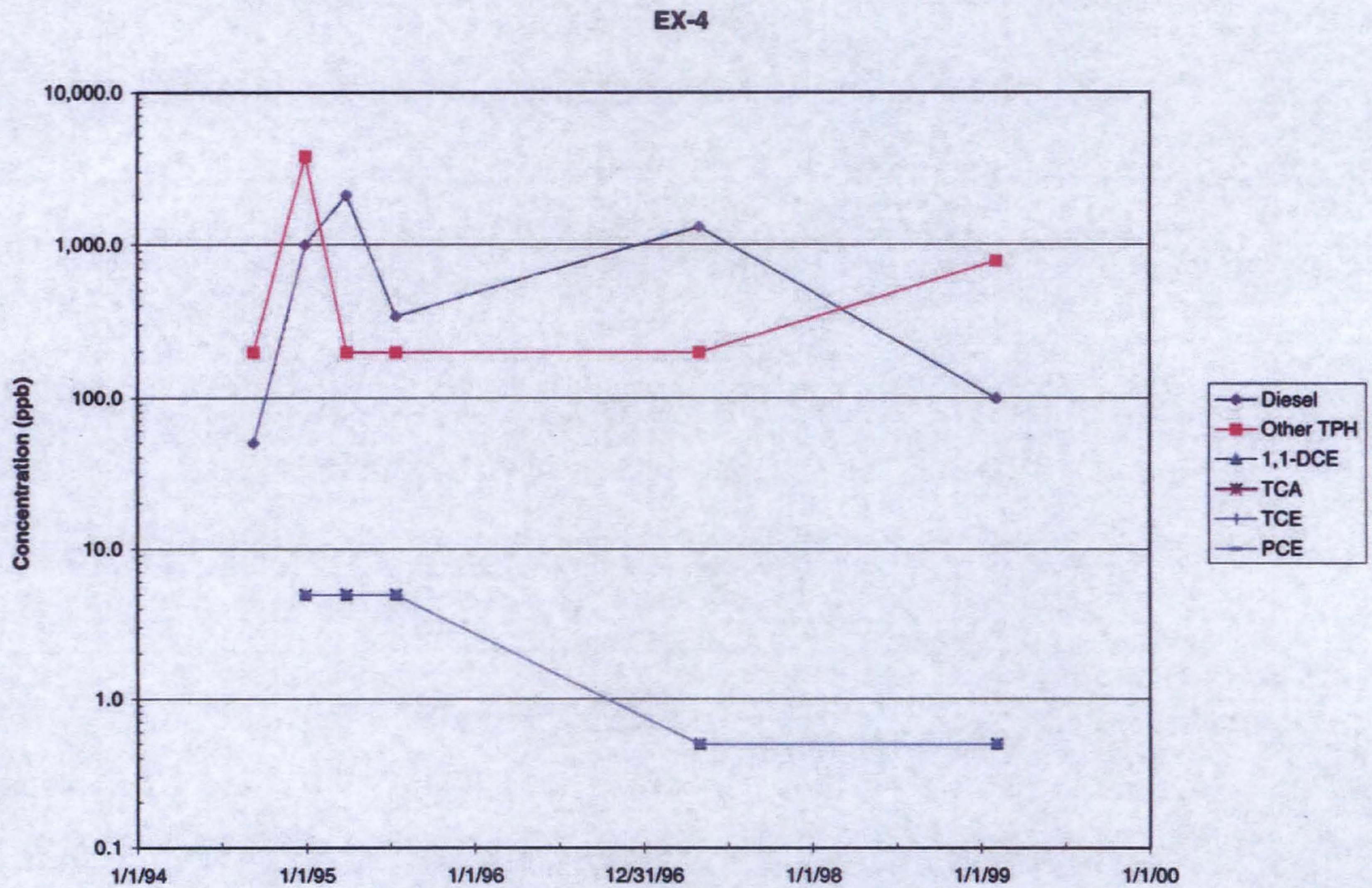
EX-2



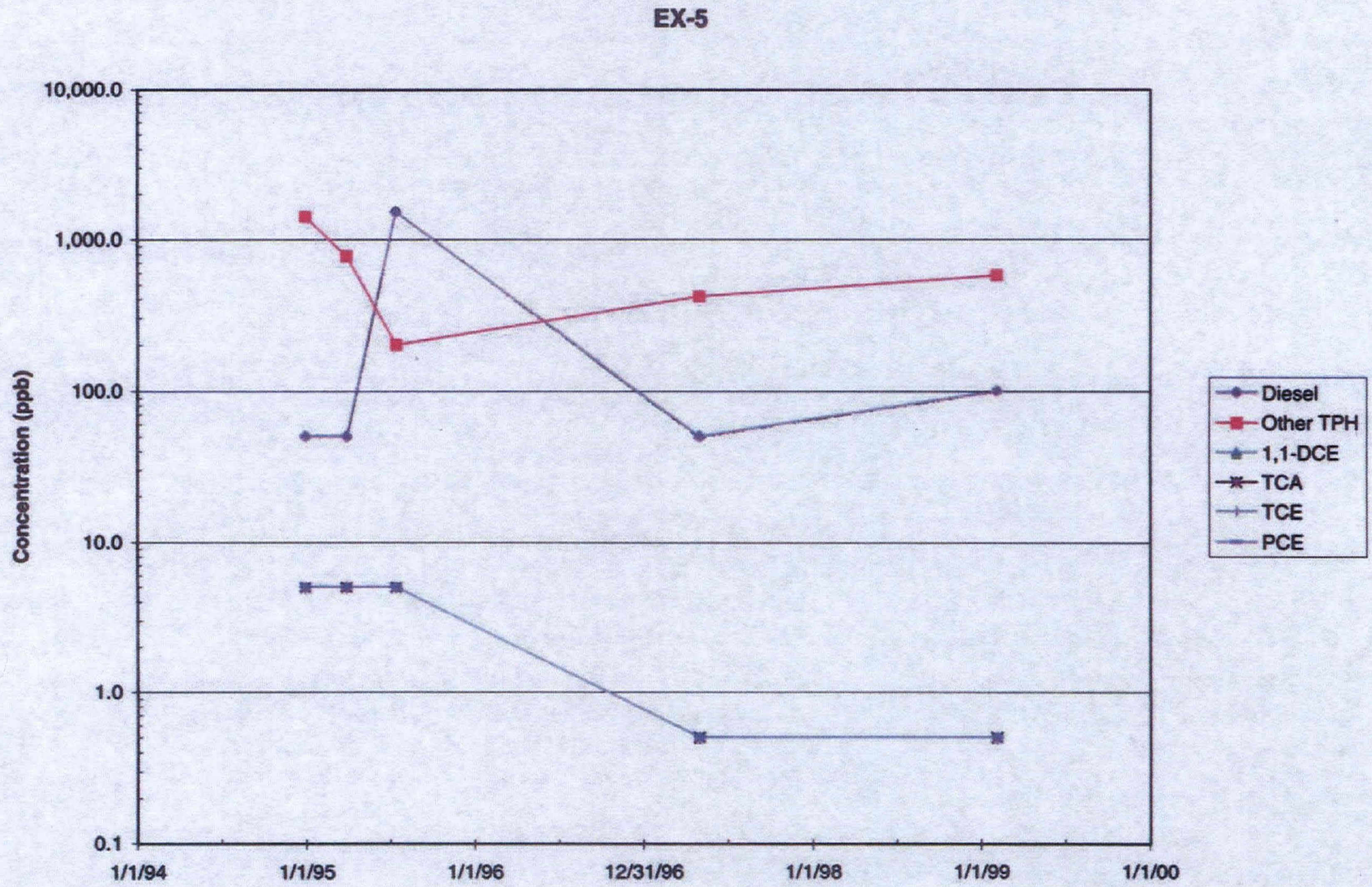
EX-2
Concentrations (ppb)
1,000.0
100.0
10.0
1.0
0.1
1/1/94
1/1/95
1/1/96
12/31/96
1/1/98
1/1/99
1/1/00
Diesel
Other TPH
1,1-DCE
TCA
TCE
PCE

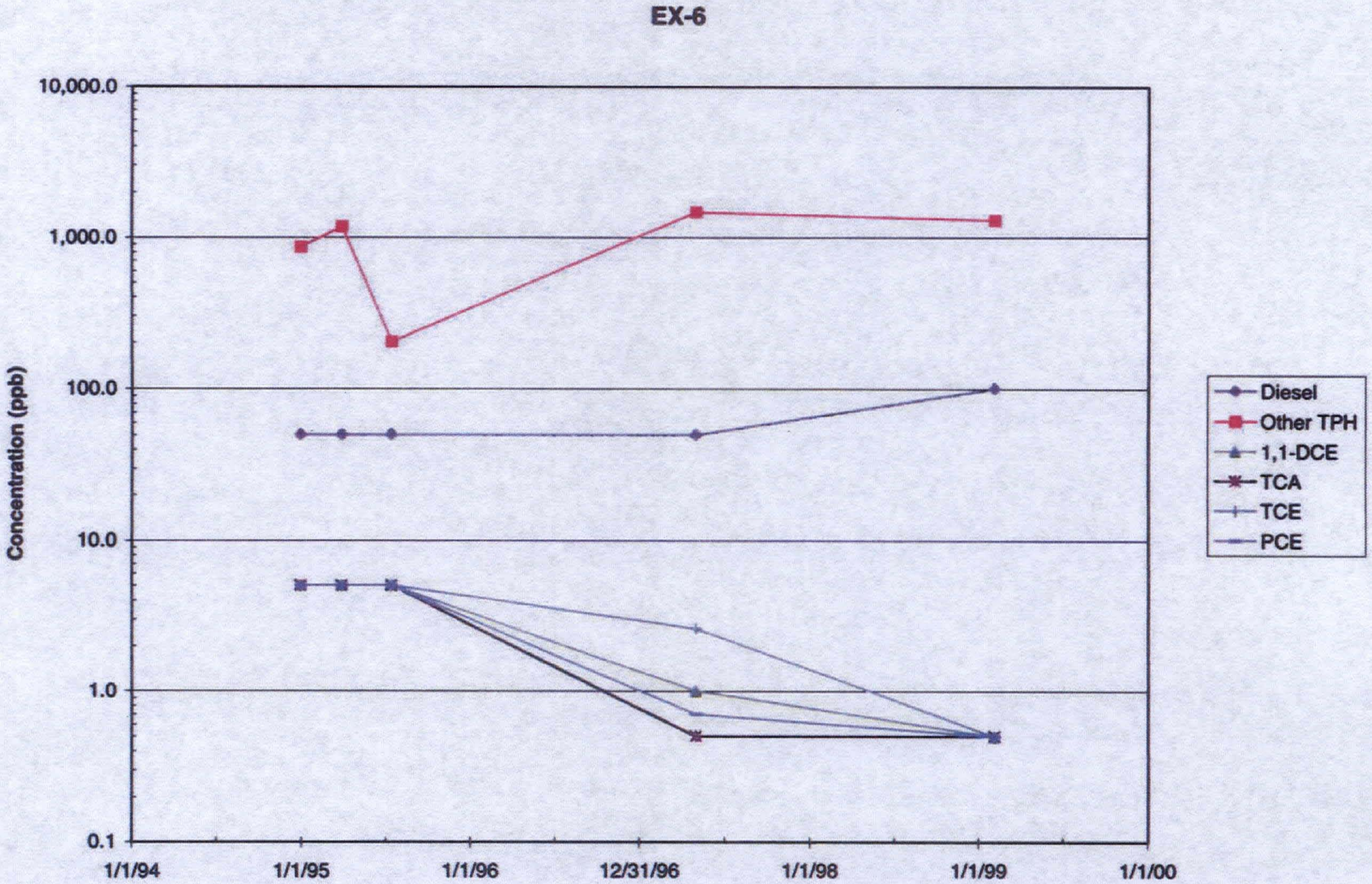
EX-3


1000
100
10
1
0.1
Concentration (ppb)
1/1/94
1/1/95
1/1/96
12/31/96
1/1/98
1/1/99
1/1/00
Diesel
Other TPH
1,1-DCE
TCA
TCE
PCE



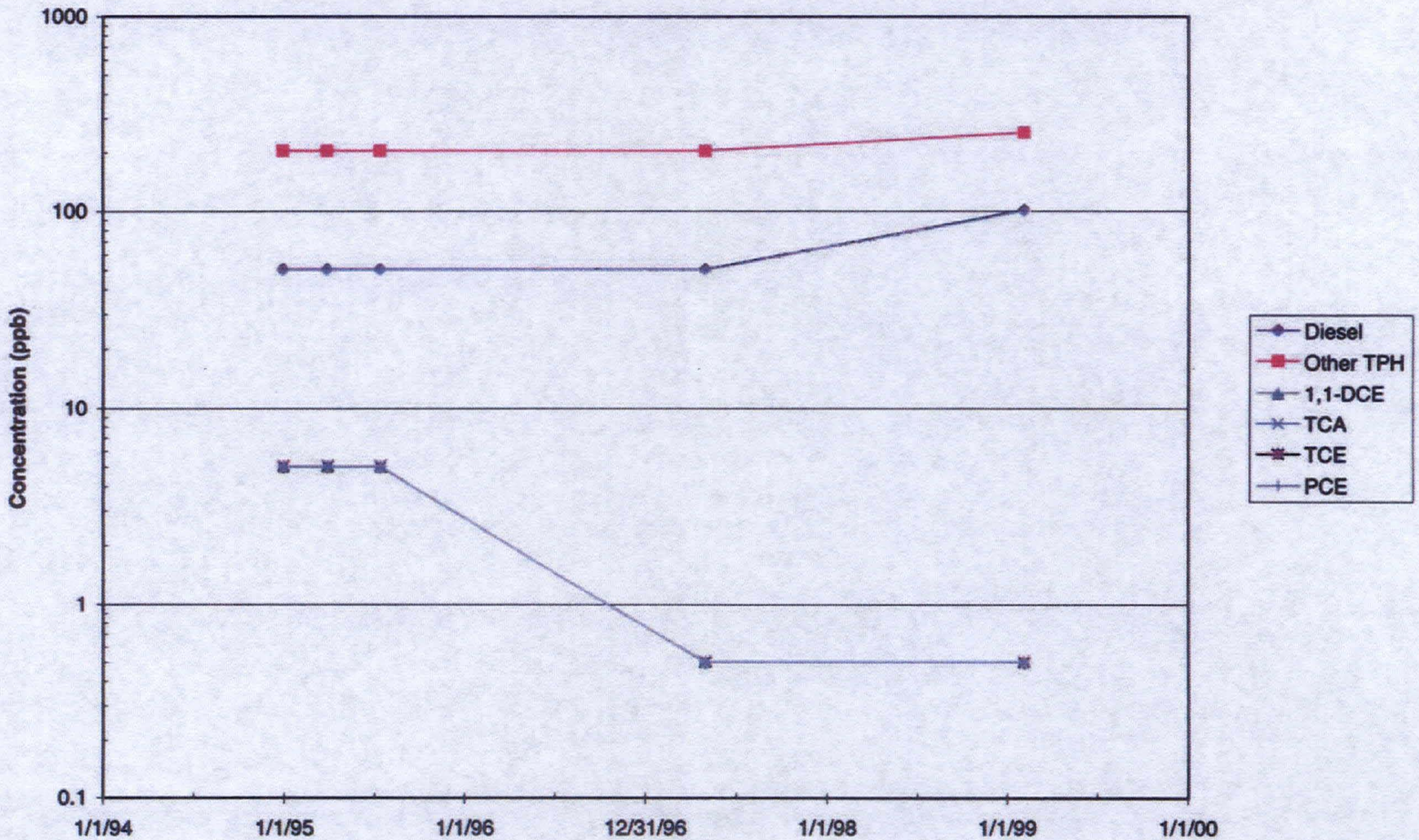
EX-4
10,000.0
1,000.0
100.0
10.0
1.0
0.1
Concentration (ppb)
1/1/94
1/1/95
1/1/96
12/31/96
1/1/98
1/1/99
1/1/00
Diesel
Other TPH
1,1-DCE
TCA
TCE
PCE


EX-5
10,000.0
1,000.0
100.0
10.0
1.0
0.1
Concentration (ppb)
1/1/94
1/1/95
1/1/96
12/31/96
1/1/98
1/1/99
1/1/00
Diesel
Other TPH
1,1-DCE
TCA
TCE
PCE



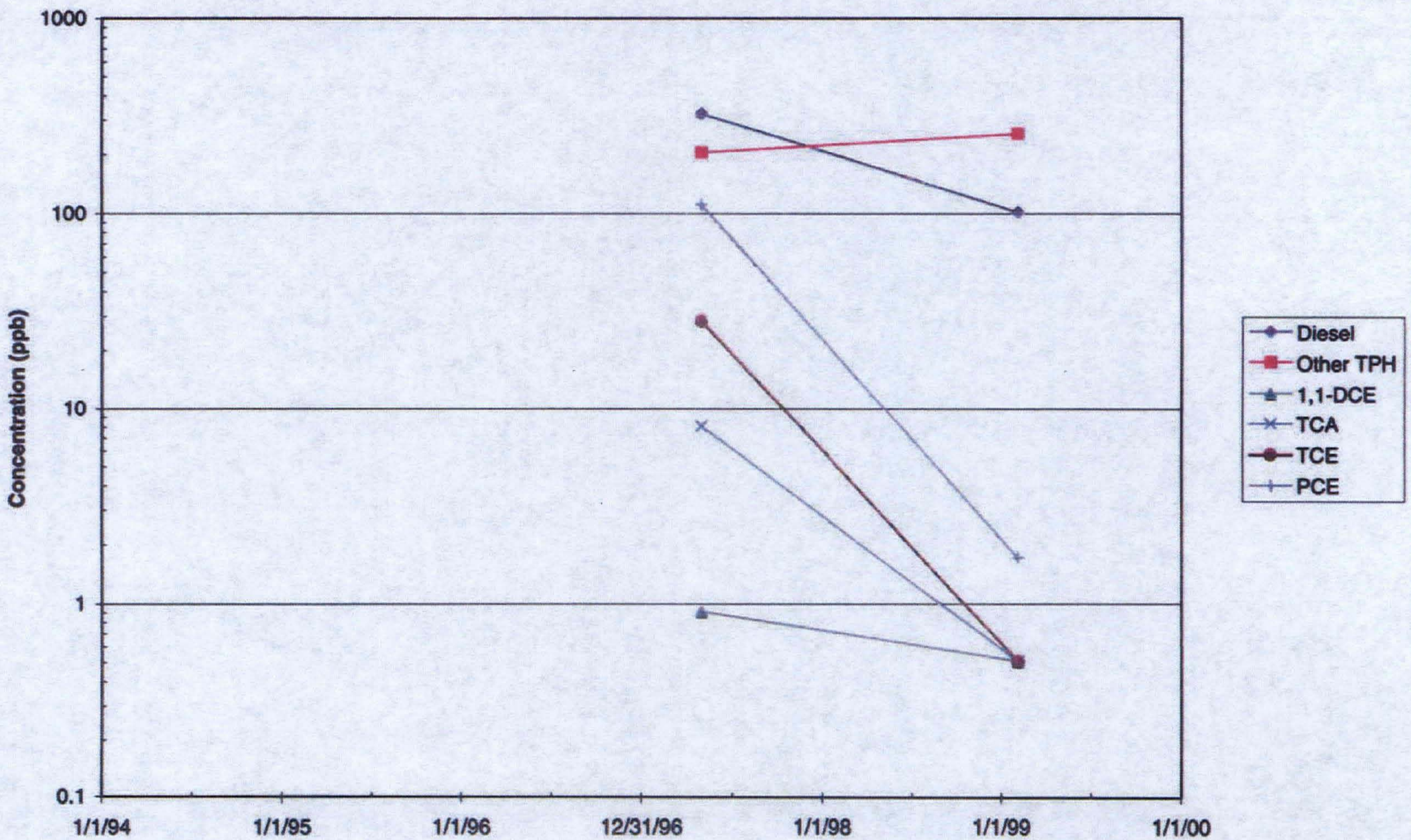
EX-6
10,000.0
1,000.0
100.0
10.0
1.0
0.1
Concentration (ppb)
1/1/94
1/1/95
1/1/96
12/31/96
1/1/98
1/1/99
1/1/00
Diesel
Other TPH
1,1-DCE
TCA
TCE
PCE

EX-7

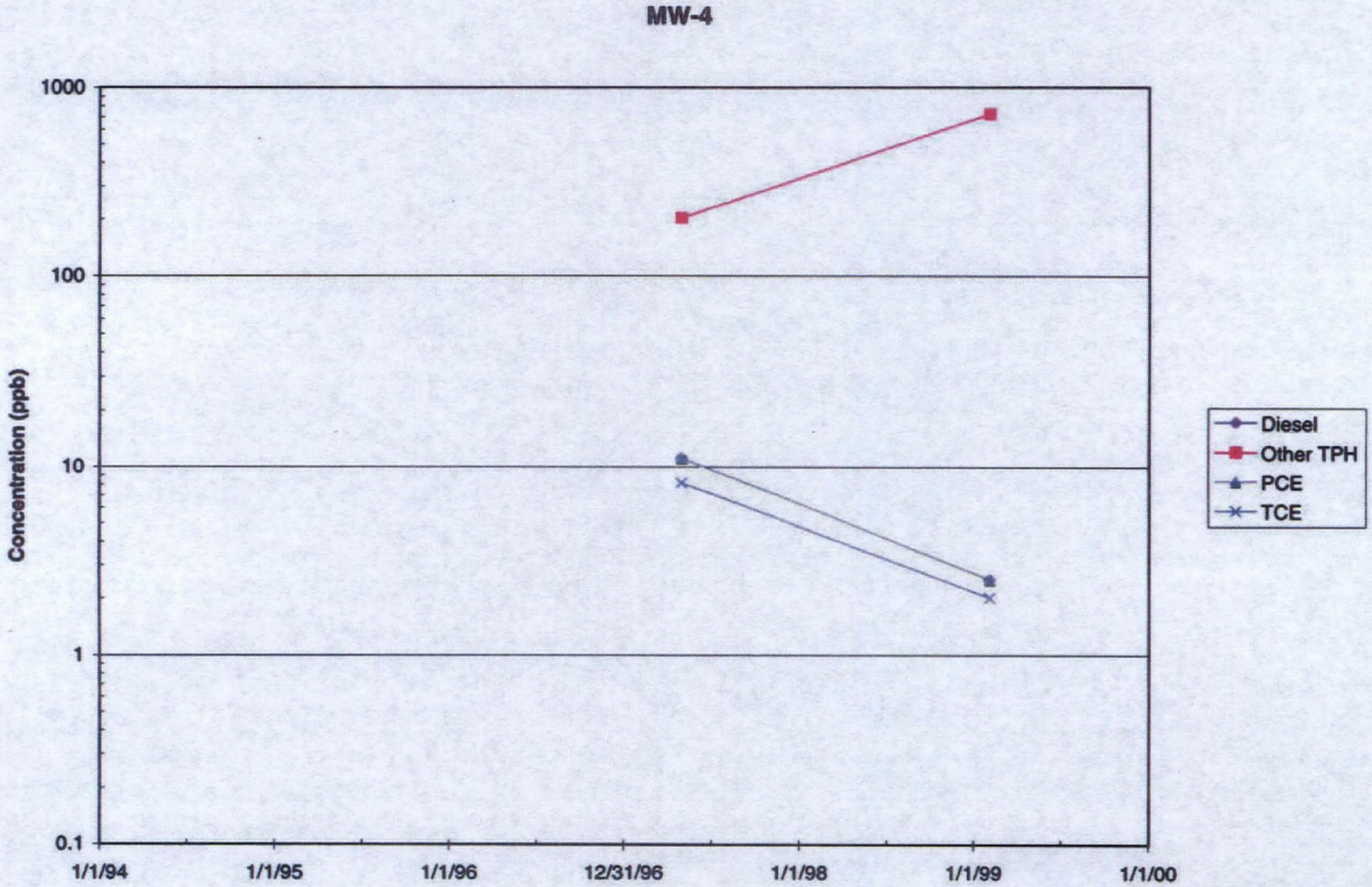


1000
100
10
1
0.1
Concentration (ppb)
1/1/94
1/1/95
1/1/96
12/31/96
1/1/98
1/1/99
1/1/00
Diesel
Other TPH
1,1-DCE
TCA
TCE
PCE

MW-1



Concentration (ppb)
1000
100
10
1
0.1
1/1/94
1/1/95
1/1/96
12/31/96
1/1/98
1/1/99
1/1/00
Diesel
Other TPH
1,1-DCE
TCA
TCE
PCE



MW-4
1000
100
10
1
0.1
Concentration (ppb)
1/1/94
1/1/95
1/1/96
12/31/96
1/1/98
1/1/99
1/1/00
Diesel
Other TPH
PCE
TCE

E-1

HAHN AND ASSOCIATES, INC.
ENVIRONMENTAL MANAGEMENT

ORIGINAL IS
IN PROJECT
FILING

September 29, 1989

Mr. Doug Richardson
Great Western Chemical
5540 NW Front Avenue
Portland, Oregon 97210

HAI Project: GWCUST 1156

SUBJECT: UST Decommissioning Final Report

Dear Mr. Richardson:

Enclosed are three copies of the final report prepared by Hahn and Associates, Inc. (HAI) relating to the permanent decommissioning of one underground gasoline storage tank (UST) formerly located at the Great Western Chemical (GWC) facility, 5540 NW Front Avenue, Portland, Oregon. All the tasks associated with this project have been completed and are described in the final report.

The soil beneath the UST was contaminated with gasoline, but at levels below the Oregon DEQ soil cleanup standards for this site. Consequently, the contaminated soil was not removed from the excavation.

One copy of this final report should be retained on file at the GWC facility,. Another copy should be sent to: Mr. Loren Garner, UST Engineer, Oregon DEQ, NW Region, 811 SW 6th Avenue, Portland, Oregon, 97204.

If there are any questions or comments regarding this project, please contact the undersigned.

Sincerely,

Phil Ralston

Philip Ralston
Scientist

434 NW SIXTH AVENUE, SUITE 203 • PORTLAND, OREGON 97209-3600
503/796-0717 OFFICE • 503/222-4178 FAX

UNDERGROUND STORAGE TANK DECOMMISSIONING

Great Western Chemical
5540 NW Front Avenue
Portland, Oregon

September 29, 1989

Prepared for:

Great Western Chemical
Portland, Oregon

Prepared by:

Hahn and Associates, Inc.
Portland, Oregon

Project No. 1156

TABLE OF CONTENTS

EXECUTIVE SUMMARY

On August 16, 1989, one underground storage tank (UST) was permanently decommissioned by removal at the Great Western Chemical (GWC) facility located at 5540 NW Front Avenue, Portland, Oregon. At the time of the decommissioning, the tank was owned by GWC. The tank was determined to be a 1,000 gallon tank that was used to store gasoline. Following the removal of the UST, the soil underneath the tank was characterized by sampling and analyses for total petroleum hydrocarbons in order to determine if soil contamination had resulted from the use of the UST.

Laboratory analyses of the soil samples indicated that soil contamination had occurred. However, the level of contamination discovered was below the Oregon Department of Environmental Quality (DEQ) soil cleanup standard applicable to the site, as determined by the DEQ cleanup level decision matrix.

Based upon the soil sample analytical results and the DEQ cleanup standards for this site, no further investigation or remedial actions appeared to be necessary at the site.

INTRODUCTION

Great Western Chemical (GWC) has retained the environmental management firm of Hahn and Associates, Inc (HAI) to complete the permanent decommissioning of one 1,000 gallon underground gasoline storage tanks (UST) at the GWC facility located at 5540 NW Front Avenue, Portland, Oregon. The UST was used by GWC to store gasoline for the vehicle fleet operations located on the site. The exact age of the UST was unknown, but according to GWC personnel it was at least 20 years old.

The UST was located adjacent to a loading ramp outside the south side of the GWC warehouse/office complex (Figure 1). The 1,000 gallon gasoline UST was situated in a east-west orientation was buried approximately 5 feet under the asphalt surface of the parking lot and was surrounded by sand backfill. The soils surrounding the UST and the native soil below the pit were highly permeable sands. The depth of these sands was unknown, as no soil borings were made to determine the soil profile. However, the soil below the UST, for at least 2 feet, was compacted sand that was a slightly different color than the gravel/sand used to backfill around the UST at the time of the installation.

The scope of work to decommission the UST consisted of four tasks: 1- tank and pipe cleaning and inerting; 2- excavation and transport of the tank to an approved disposal site, and restoration of the disturbed area; 3- sampling of the excavation to determine if any product had leaked into the surrounding soils; and 4- filing the required registrations and permits with the Oregon Department of Environmental Quality (DEQ) and City of Portland and completing the required regulatory reporting.

DECOMMISSIONING OF UST: TASKS COMPLETED

TASKS 1: TANK and PIPE CLEANING and INERTING

The contents of the UST was known by GWC operations personnel as being gasoline. Therefore, sampling and analyses of the UST contents was not necessary.

Pacific Coast Environmental, Inc. (PCE) (5555 N. Channel, Portland, Oregon) was contracted to clean the UST and dispose of the gasoline contaminated rinsate. On August 2, 1989, PCE performed the tank and pipe cleaning. PCE pumped and removed approximately 200 gallons of gasoline/water rinsate from the UST as part of the tank cleaning operation. The rinsate from the UST was transported via a PCE pump truck to Fuel Processors, Inc. (4150 N. Shuttle Road, Portland, Oregon) for recycling.

Prior to excavation of the tank, the potentially explosive gasoline vapors in the tank were removed by adding dry ice to the tank (1.5 pounds dry ice per 100 gallons of tank volume) to displace the vapors. Mr. Carlton Bruce, a Certified Marine Chemist from Marine and Environmental Testing (MET) (4115 N. Mississippi, Portland, Oregon) inspected the tank for the presence of explosive vapors. Inspection using a gas analyzer indicated the lack of explosive vapors in the tank prior to its excavation.

TASK 2: EXCAVATION and TRANSPORT of the UST to PERMITTED DISPOSAL SITE and RESTORATION OF THE DISTURBED AREA

The UST was excavated on August 16, 1989, by Bob's Sanitary Service (3011 SW Canby, Portland, Oregon) and was placed at the edge of the excavation. Bob's Sanitary is an experienced construction firm that specializes in excavation of underground piping and tanks. While on-site at GWC, Bob's Sanitary worked under the direction of HAI. At the time of this project, the DEQ regulations requiring persons supervising UST projects to be licensed had been adopted but not implemented.

At the time that the soil surrounding the UST was removed there was no odor or visual evidence of hydrocarbon releases from the UST or its associated piping.

A 4" concrete pad above the UST, and directly below the asphalt surface, was an unexpected impediment to excavation and required additional jackhammer work to gain access to the UST. In addition, a 12" water pipe lay above the eastern edge of the UST, also causing an unexpected barrier to the UST removal. The UST was removed without damage to the water line. These two unforeseen circumstances caused some delay in the excavation process.

The UST fill, vent and product delivery pipes were all drained of gasoline, detached from the UST and removed from the site. The excavated soil was stockpiled next to the excavation pending receipt of the results of the soil analyses.

There was no evidence of any breaches or holes in the tank that indicated that the tank would be the source of product leaks to the environment. The clean and inerted tank was transported from the site by Bob's Sanitary Service and was sold as scrap to Schnitzer Steel, 12005 N. Burgard Road, Portland, Oregon. The scrap tank was then shredded by Schnitzer Steel and sent to Cascade Steel Rolling Mills, McMinnville, Oregon for melting and recycling.

After the soil remaining in the excavation was determined to be contaminated at levels below the DEQ cleanup standards (see Task 3 below), the excavation was filled in with clean soil, compacted and the resurfaced with asphalt.

TASK 3: EXCAVATION SOIL SAMPLING

Immediately after the tank was removed from the excavation, two soil samples were obtained from the excavation in an attempt to characterize any hydrocarbon release that may have come from the use of the UST (Figure 2). The two samples were taken from the bottom of the pit at points 6 - 12 inches directly below the location of the ends of the UST center line. The samples were placed in clean glass jars, the jars placed in a chilled shipping container and transported to Pacific Environmental Laboratory (PEL) (9405 SW Nimbus Ave., Portland, Oregon) for analyses.

The analytical results indicated that the soil was contaminated by petroleum hydrocarbons, but at levels below the DEQ petroleum-contaminated soil cleanup standard for this site (Table 1). The appropriate cleanup level for this site was determined by using the DEQ soil cleanup level decision matrix (OAR 340-122-205 to -360) (Appendix 2). The cleanup level for gasoline contaminated soil at this site was determined to be at or below 80 parts per million total petroleum hydrocarbon (TPH).

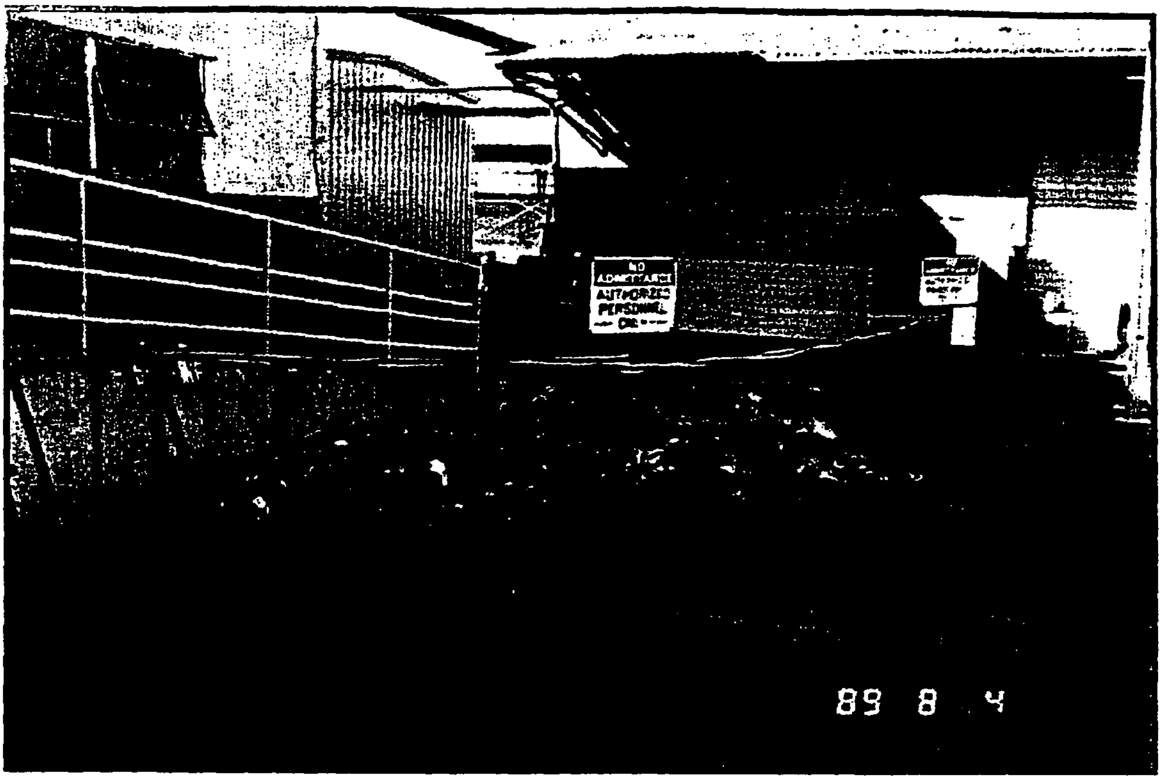
The analyses of the two soil samples taken from the bottom of the pit, one each from the east and west end, showed TPH concentrations at 37 ppm and 69 ppm, respectively. In summary, the soil contamination discovered after the UST removal was below the DEQ cleanup standards for gasoline contamionation.

Therefore, further soil excavation, as specified by DEQ regulations, was not necessary. Additional sampling was not required.

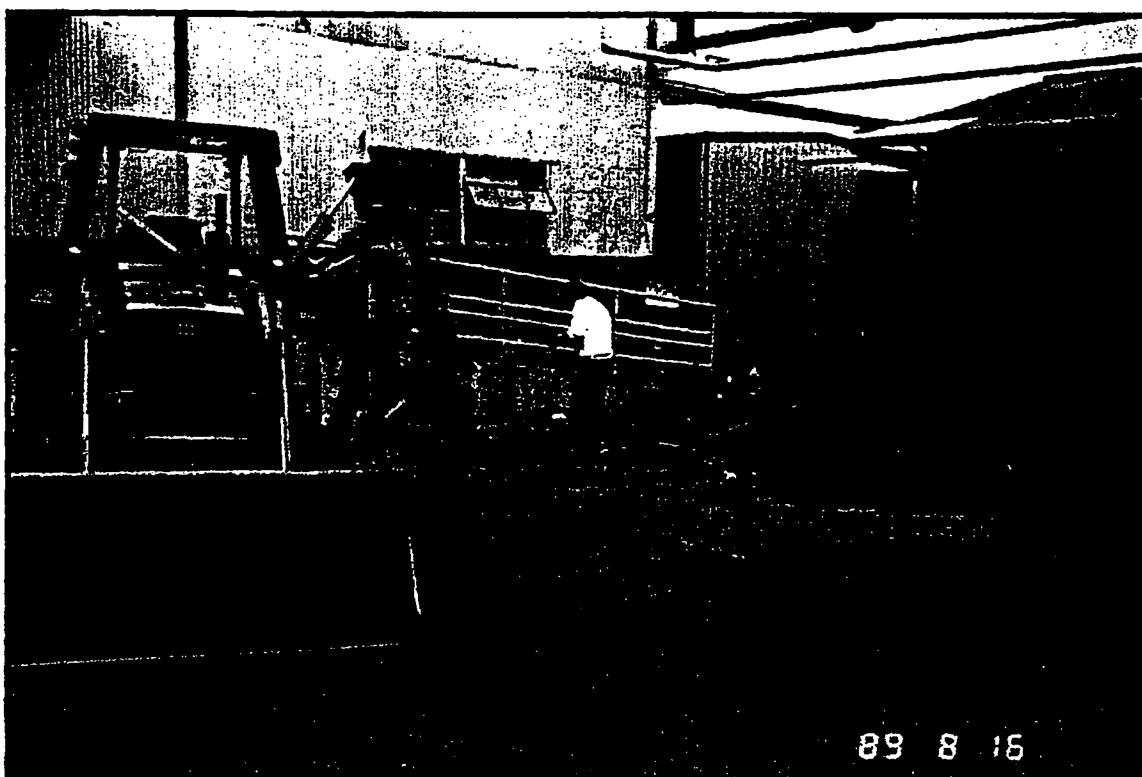
Soil removed from the top and sides of the UST during the tank excavation was then used to backfill the pit.

TASK 4: REGISTRATIONS, PERMITS and REGULATORY REPORTING

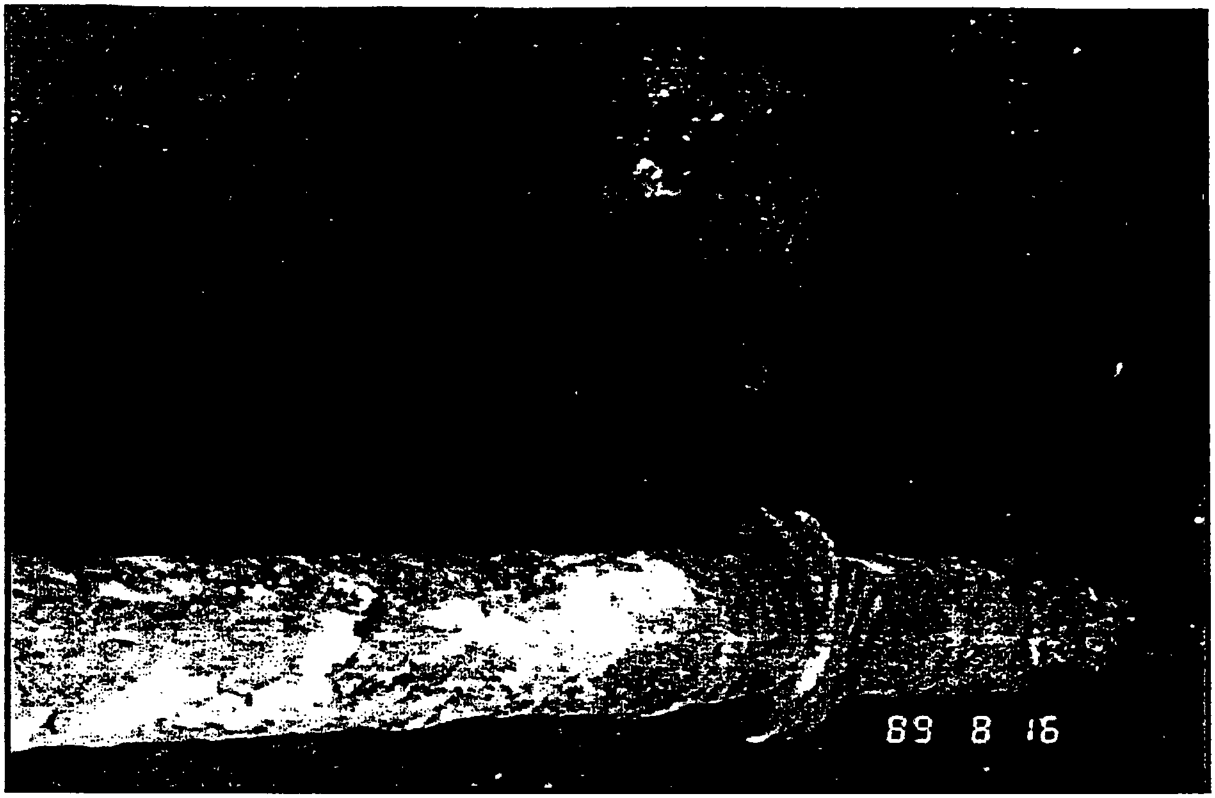
Federal and state regulations required that the UST be registered with the DEQ. The UST was registered with the DEQ Underground Storage Tank Program prior to decommissioning. The "Notice of Underground Storage Tank Permanent Decommissioning" was submitted to the DEQ, and the City of Portland Fire Prevention Division "UST Decommissioning Permit" for this work was also obtained prior to commencing the project (Appendix C).



Photograph 1. View of the excavation site with broken asphalt (August 4, 1989).



Photograph 2. View of the excation in progress (August 16, 1989).



Photograph 3. View of piping in the UST pit (August 16, 1989).

Photograph 4. View of an area of corrosion on the side of the UST (August 16, 1989).

NOTICE OF UNDERGROUND STORAGE TANK
PERMANENT DECOMMISSIONING

Facility

Name Great Western Chemical Company
Address 5540 NW Front Ave
Portland, OR 97210

Phone 242-0200
Facility ID Number 4749

Tank Owner

Name — Same as Facility —
Address

Phone

Permanent Decommissioning Performed By:

Company Hahn & Associates, Inc Phone 796-0717
Scheduled Date for Permanent Decommissioning Aug 4-9, 1989
Method to be used: Removal ✓ In-Place Fill Material

Tanks to be Decommissioned

Tank ID#	Tank Age	Tank Size	Last Product Stored
1	unknown	1,000 gal	gasoline

Are the decommissioned tanks to be replaced by new underground storage tanks? Yes ☐ No ☒
If yes, please submit a new permit application containing information on the new tanks.

Where and how will the old tanks be disposed?

Scrap	Name Schnitzer Steel	Location Portland, OR
Landfill	Name	Location
Stored	Name	Location
Other	Comment	

Signature Philip A. Ralston, HAI for Great Western Chemical Co Date 7/31/89

Return Completed Form To:

Department of Environmental Quality
UST Program - Decommissioning Notice
811 SW Sixth Ave.
Portland, Oregon 97204

For Information: (503) 229-5559 or Toll Free in Oregon 1-800-452-4011

NEIL GOLDSCHMIDT
GOVERNOR

Department of Environmental Quality

811 SW SIXTH AVENUE, PORTLAND, OREGON 97204-1390 PHONE (503) 229-5696

January 22, 1990

Mr. Doug Richardson
Great Western Chemical
5540 NW Front Avenue
Portland, Oregon 97210

Re: UST-Multnomah County
Great Western Chemical

Dear Mr. Richardson:

We have completed our review of Hahn and Associates' report, dated September 29, 1989, concerning the underground storage tank decommissioning at your facility located at 5540 NW Front Avenue in Portland, Oregon. Since this information indicates that the decommissioning met our current criteria, no further action is required at this time.

This decision is a result of our evaluation and judgement based on the regulations and facts as we now understand them, including:

1: The 1,000 gallon gasoline underground storage tank was removed from the site and taken to Schnitzer Steel Products for recycling.

2: No obvious contamination was present in the tank excavation. Confirmatory soil sample analyses detected 37 and 69 parts per million (ppm) total petroleum hydrocarbons. These levels were below the matrix cleanup level established for the site of 80 ppm.

3: No groundwater was encountered in the excavation.

Information concerning the tank removal should be maintained with the permanent facility records. We remind you that the current investigation applies only to the underground storage tank system and in no way transfers any liability to the State of Oregon.

Although we agree that the current conditions at the site do not appear to pose an environmental threat, the responsibility for environmental evaluation, reporting, and cleanup rests with the landowners.

If you have any questions regarding this matter, please contact Andree Pollock at 229-6923.

Sincerely,

Edward Woods

Edward G. Woods
Regional Manager
Northwest Region

cc: Environmental Cleanup Division, UST Section
Hahn and Associates, Inc.
434 NW 6th Avenue, Suite 203
Portland, Oregon 97209-3600
Attn: Philip Ralston